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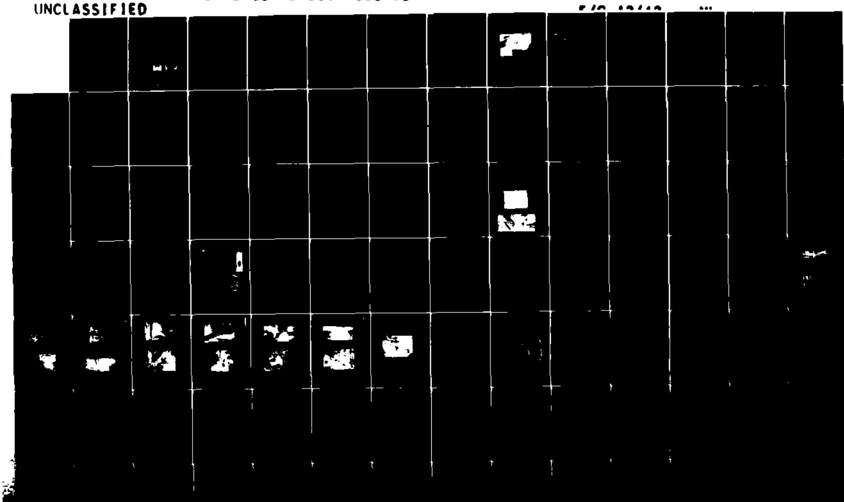

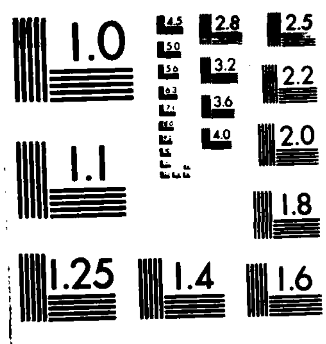

MICROCOPY RESOLUTION TEST CHART
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AD-A156 387

CONNECTICUT RIVER BASIN

ENFIELD, NEW HAMPSHIRE

SMITH POND DAM

NH 00073

STATE NO 77.12

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Connecticut Rwver Basin
Enfield New Hampshire
Unnamed tributary to Mascoma Lake

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam has a hydraulic height of 11 ft. and is about 150 ft. long. It is an earthen embankment contained between dry masonry walls; the upstream wall has been crudely faced with concrete. The dam is in poor condition. Among various major concerns are seepage at two of the four dikes and the large trees growing on the dikes. It is small in size with a significant hazard classification.

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NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No.:	NH00073
Name of Dam:	Smith Pond Dam
Town:	Enfield
County and State:	Grafton County, New Hampshire
Stream:	Unnamed tributary to Mascoma Lake
Date of Inspection:	May 9, 1979

BRIEF ASSESSMENT

Smith Pond Dam has a hydraulic height of 11 feet, is about 18 feet wide, and is about 150 feet long. It is an earthen embankment contained between dry masonry walls; the upstream wall has been crudely faced with concrete. The dam has a concrete spillway and a low-level gate which is inoperable. The dam forms the headwaters of an unnamed tributary to Mascoma Lake, and is located in west central New Hampshire. The dam, along with four dikes, contain runoff from a 0.9 square mile drainage area. Maximum storage capacity is about 775 acre-feet. Smith Pond Dam is used as an upstream storage reservoir for water supply. The pond is slightly less than a half mile in length with a surface area of about 62 acres.

The dam is in poor condition. Major concerns are: the inadequate spillway capacity, the lack of an operable gate for the low-level conduit, the 15-foot long depression in the dam crest over the conduit, seepage at two of the four dikes, and the large trees growing on the dikes.

Based on small size and significant hazard classification in accordance with Corps guidelines, the test flood is ½ Probable Maximum Flood (PMF). A test flood outflow of 1080 cfs (1200 csm) would overtop the dam by about 1.4 feet. The spillway capacity is 40 cfs which is only 4 percent of the test flood discharge; therefore the spillway is considered inadequate. A major breach at top of dam could result in the loss of 4-6 lives and appreciable property damage.

The owner, LaSalette Seminary, should implement the results of the recommendations and remedial measures given in Sections 7.2 and 7.3 within one year after receipt of this Phase I inspection report.

Warren A. Guinan
Warren A. Guinan
Project Manager
N.H. P.E. 2339

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon a ailable data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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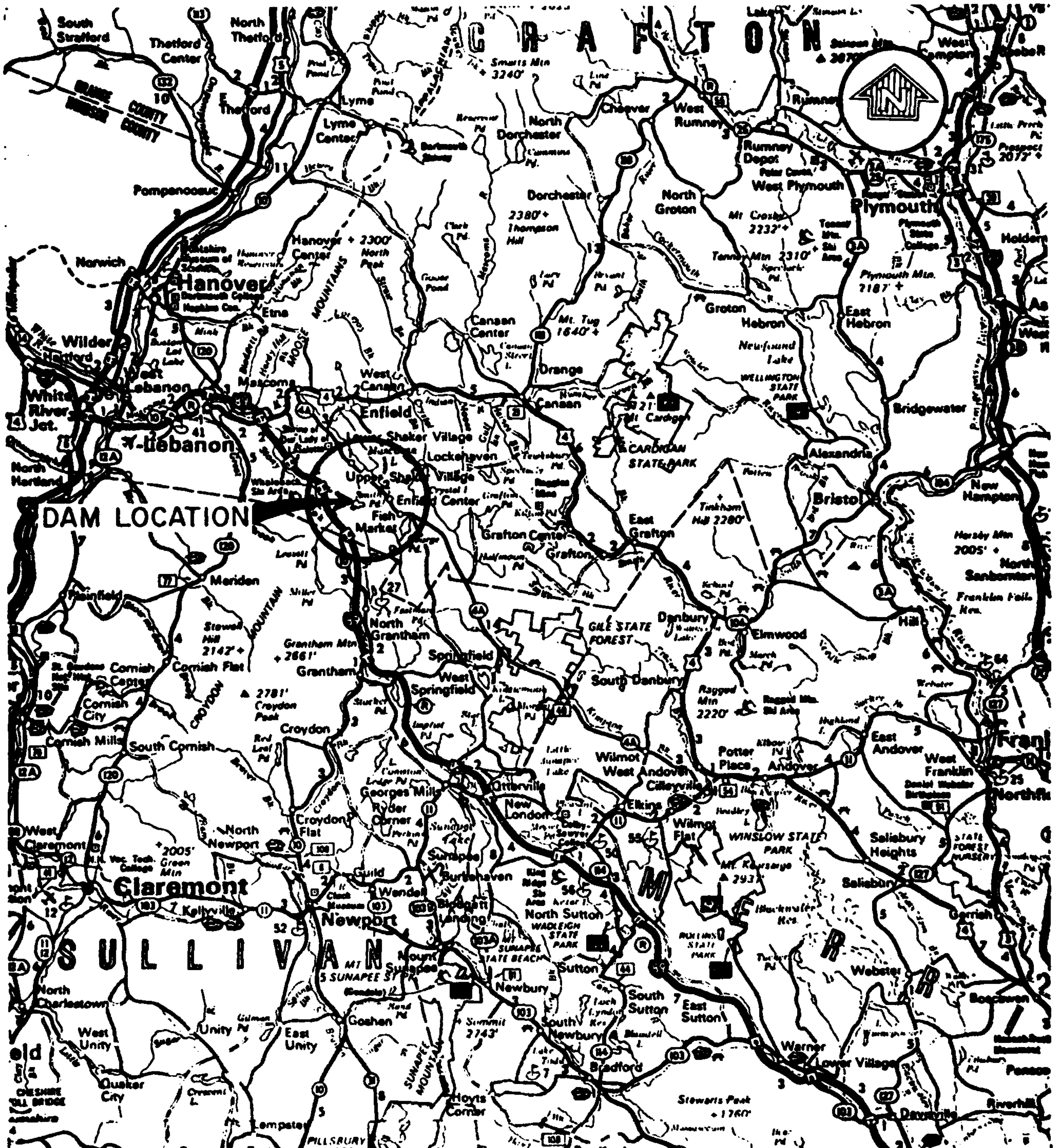
March 1979
Figure 1 - Overview of Smith Pond Dam.



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SCALE IN MILES

0 5 10

MAP BASED ON STATE OF NEW HAMPSHIRE OFFICIAL HIGHWAY MAP.

Anderson-Nichols & Co., Inc. CONCORD NEW HAMPSHIRE	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

SMITH POND DAM LOCATION MAP

SMITH POND NEW HAMPSHIRE

SCALE: SEE BAR SCALE

DATE: JULY, 1979

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
SMITH POND DAM

SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Anderson-Nichols & Company, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed were issued to Anderson-Nichols under a letter of November 20, 1978 from Max B. Scheider, Colonel, Corps of Engineers. Contract No. DACW33-79-C-0009 has been assigned by the Corps of Engineers for this work.

b. Purpose

(1) To perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) To encourage and prepare the State to initiate quickly effective dam safety programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. Smith Pond Dam is located in the Town of Enfield, New Hampshire and forms the headwaters of an unnamed tributary to Mascoma Lake. After discharging at the damsite the unnamed tributary flows northerly for a distance of about 1.4 miles before emptying into Mascoma Lake. Smith Pond Dam is shown on U.S.G.S. Quadrangle, Mascoma, New Hampshire with coordinates approximately at N 43° 35' 24", W 72° 06' 18", Grafton County, New Hampshire. (See Location Map page vii.)

b. Description of Dam and Appurtenances. Smith Pond Dam is an earthen embankment dam with a nearly vertical dry masonry upstream face which has a crudely constructed concrete facing and a nearly vertical dry masonry wall on the downstream side. The dam totais 150 feet in length, has a structural height of 13 feet, and averages 18 feet wide at the crest. The dam was built with a dog leg at

about 60 feet from the right (east) abutment with an angle of about 30° from the axis through the portion containing the spillway. The concrete spillway consists of a 4.7-foot wide by 1.1-foot high stoplog facility which has been constructed through the top of the dam. A low-level conduit passes through the dam estimated to be about 3 square feet in cross-section. An inoperable gate covers the upstream opening and has been wedged open partially to allow a small amount of discharge (estimated to be 1 cfs). Four low dikes, two east and two west of the dam, are required to retain the pond. The near west dike is about 150 feet west of the west dam abutment and is about 50 feet long. The far west dike is about 800 feet west of the dam. It is 80 feet long and about 6 feet in height. The near east dike is about 500 feet east of the dam; it is 160 feet long and 6 feet in height. The far east dike is about 900 feet east of the dam; it is about 25 feet long and about 2.5 feet high.

c. Size Classification. Small (hydraulic height - 11 feet; storage - 775 acre-feet based on height and storage ($<$ 40 feet in height and $\geq$ 50 to $<$ 1,000 acre-feet) as given in Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification. Significant Hazard. A major breach could result in a loss of 4-6 lives and appreciable property damage. (See Section 5.1 f.)

e. Ownership. Smith Pond Dam was originally constructed and owned by the Shakers. Ownership was passed to LaSalette Seminary at some unknown date around 1927.

f. Operator. The current owner and operator of Smith Pond Dam is LaSalette Seminary, Enfield, New Hampshire 03748. Phone: (603) 632-5533.

g. Purpose. The original purpose for the construction of the dam by the Shakers is not known. It is believed they may have used it for water storage. The Shakers constructed a diversion channel six feet wide at varying depths from the main channel about one mile across the base of the mountain to their village. The current owner, LaSalette Seminary, utilizes the upstream storage for water supply including drinking, kitchen, toilets, fire hydrants and irrigation of gardens.

h. Design and Construction History. Little is known about the design or construction of the dam. According to information contained in the files of the NHWRB, the dam was built illegally by the Shakers in the late 1800's. Under ownership by the LaSalette Seminary, some reconstruction took place in 1947. No plans or design data were revealed for this reconstruction.

i. Normal Operating Procedures. No written operating procedures exist for Smith Pond Dam. During the summer months, the dam is visited usually every two weeks by the owner. Any major deficiencies are reported. During periods of little rainfall, water is diverted from the main channel into the diversion channel to supply water for the Seminary. This diversion is

accomplished by obstructing flow in the main channel and forcing water into the diversion channel.

1.3 Pertinent Data

a. Drainage Area. The drainage area consists of 0.9 square mile (576 acres) that is predominantly wooded terrain. The normal surface area of Smith Pond is 62 acres which constitutes 11 percent of the watershed.

b. Discharge at Damsite

(1) Outlet works (conduit) - one low-level outlet of unknown size. The gate is presently inoperable.

(2) The maximum discharge at the dam is unknown.

(3) Ungated spillway capacity at top of dam - 40 cfs @ 1651.3' MSL

(4) Ungated spillway capacity at test flood elevation - 120 cfs @ 1652.7' MSL

(5) Gated spillway capacity at top of dam - not applicable

(6) Gated spillway capacity at test flood elevation - not applicable

(7) Total spillway capacity at test flood elevation - 120 cfs @ 1652.7' MSL

(8) Total project discharge at test flood elevation - 1080 cfs @ 1652.7' MSL

c. Elevation (ft. above MSL; see (6) below)

(1) Streambed at centerline of dam - 1640.3 (downstream toe)

(2) Maximum tailwater - unknown

(3) Upstream invert low-level outlet - unknown

(4) Recreation pool - not applicable

(5) Full flood control pool - not applicable

(6) Spillway crest - 1650 (shown on U.S.G.S. Quadrangle Sheet and assumed to be spillway crest elevation)

(7) Design Surcharge - unknown

(8) Top of dam - 1651.3 (Main dam embankment)

(9) Test flood pool - 1652.7

(10) Dike crest -

near easterly - 1651.3
far easterly - 1651.9
near westerly - 1651.3
far westerly - 1652.4

d. Reservoir (miles)

(1) Length of maximum pool - 0.45

(2) Length of pool at spillway crest - 0.45

(3) Length of flood control pool - not applicable

e. Storage (acre-feet)

(1) Recreation pool - not applicable

(2) Flood control pool - not applicable

(3) Spillway crest pool - 680

(4) Top of dam - 775

(5) Test flood pool - 920

f. Reservoir Surface (acres)

(1) Recreation pool - not applicable

(2) Flood control pool - not applicable

(3) Spillway crest - 62

(4) Test flood pool - 91

(5) Top of dam - 78

g. Dam

(1) Type - earth fill between dry masonry faces; upstream masonry has a concrete facing.

(2) Length - 150'

(3) Height - 13' (structural height)

(4) Top width - averages 18'

(5) Side Slopes - vertical upstream and downstream

(6) Zoning - unknown

(7) Impervious core - unknown

(8) Cutoff - unknown

(9) Grout curtain - unknown

h. Diversion and Regulating Tunnel - not applicable (See j. below.)

i. Spillway

(1) Type - concrete

(2) Length of weir - 4.7'

(3) Crest elevation - 1650' MSL

(4) Gates - none

(5) U/S Channel - Smith Pond. The approach channel bottom has large boulders and exposed bedrock; the banks are lined with trees.

(6) D/S Channel - Discharge over the dam and from the low-level outlet flows northerly for a distance of about 350 feet through a marshy area averaging 50 feet in width. The tributary then drops sharply into a narrow confined channel and flows for about 1.3 miles to its confluence with Mascoma Lake. The channel bottom consists of coarse gravel and boulders and is heavily obstructed with fallen trees and underbrush. State Route 4A crosses the tributary 0.1 mile upstream of the confluence with Mascoma Lake. Four inhabited structures are located near this crossing.

A diversion channel was constructed by the Shakers to provide water for their village. This diversion channel branches off from the main channel about 1 mile downstream of the dam and totals approximately 2 miles in length. The channel is six feet wide and its banks vary from three to eight feet high. This channel flows along the base of a mountain and crosses two other unnamed tributaries to Mascoma Lake. It also provides additional inflow into two small storage reservoirs.

j. Regulating Outlets. One inoperative low-level gate, of unknown size, passes discharge through a conduit under the dam into the downstream channel. The gate is presently partially open allowing flow; no operating mechanism exists.

SECTION 2
ENGINEERING DATA

2.1 Design

No original design data were obtained for Smith Pond Dam. However, in a letter sent to the New Hampshire Water Resources Board (NHWRB) from LaSalette Seminary, there is a sketch of the dam with approximate measurements and two photographs of the dam were obtained. (See sketch in Appendix B.)

2.2 Construction

No construction data were disclosed for Smith Pond Dam.

2.3 Operation

No engineering operational data were disclosed.

2.4 Evaluation

a. Availability. Little engineering data were found for Smith Pond Dam. A search of the files of the NHWRB and direct contact with the owner, revealed only a limited amount of recorded information.

b. Adequacy. The final assessments and recommendations of this investigation are based primarily on the visual inspection and the hydrologic and hydraulic calculations.

c. Validity. Visual inspection of the dam and spillway reflect that the sketched plan generally conforms to the existing structure.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. Smith Pond Dam is a low dam which impounds a reservoir of small size. The watershed above the reservoir is steep and heavily wooded. The downstream area is steep and heavily wooded.

b. Dam. Smith Pond Dam is an earthen embankment dam with a hydraulic height of 11 feet, 150 feet long, and averages 18 feet wide at the crest. The upstream face of the dam is a nearly vertical dry masonry wall which has a crudely constructed concrete facing on the upstream side. (See Appendix C - Figures 2 and 3.) The downstream face of the dam is a nearly vertical dry masonry wall. (See Appendix C - Figure 4.) Soil covers most of the crest of the dam except in one area about 15 feet long. Here a depression has developed about one foot deep in which a rubble-type of fill is exposed. The depression is next to the upstream edge of the crest and is located directly above the low-level outlet. (See Appendix C - Figure 5.) Brush, coarse weeds, and saplings are growing on the crest of the dam. (See Appendix C - Figure 6.) Several large trees and some brush are growing immediately downstream of the dam. No evidence of seepage was observed on the downstream face of the dam or from the natural ground immediately downstream of the dam.

Two low earth dikes east of the dam and two dikes west of the dam were built to contain the pond. Large trees are growing on the crest, upstream slope, and downstream slope of all four dikes. (See Appendix C - Figures 7 and 8.) A footpath traverses the crest of each of the four dikes. Minor seepage was occurring at the downstream toe of the far east dike. Major seepage, estimated to be 2-3 cfs, was occurring at the downstream toe of the near east dike. (See Appendix C - Figure 9.) No seepage was observed at the downstream toe of the west dikes.

c. Appurtenant Structures. The concrete wall on the upstream face of the dam is in fair condition. Numerous hairline cracks and small spalled areas were observed in the concrete wall. No indication of differential movement was observed. Near the eastern end of the main dam a 4.7-foot wide by 1.1-foot high stoplog facility and discharge channel has been constructed through the top of the dam to serve as the principal spillway. (See Appendix C - Figure 10.) No stoplogs were in place at the time of the inspection; one stoplog slot has been cemented in hindering future use. The concrete was observed to be in deteriorated condition with several cracks and spalled areas. (See Appendix C - Figure 10.) A considerable amount of debris has collected in the spillway. (See Appendix C - Figures 10 and 11.) The spillway discharge channel is in ledge. (See Appendix C - Figure 12.)

Flow was discharging from a rectangular opening in the downstream face of the dam. (See Appendix C - Figure 13.) Available records indicate this acts as a low-level outlet. No evidence of a low-level outlet control mechanism or valve was observed during the visual inspection.

d. Reservoir Area. The watershed above the reservoir is rolling and heavily wooded. (See Appendix C - Figure 14.) No camps or other structures were observed on the shore of the reservoir. Sedimentation in the reservoir appears to be insignificant.

e. Downstream Channel. The bottom of the channel immediately downstream of the dam is in bedrock and is partially covered with boulders. Many trees overhang the channel. Two large logs lie across the main channel immediately downstream of the dam, and some debris was noted in the small channel that leads from the spillway to the main channel. (See Appendix C - Figure 15.) After discharging at the dam, the unnamed tributary flows 1.4 miles before emptying into Mascoma Lake. The State Route 4A crossing is located about 500 feet upstream of this confluence. Three inhabited structures are located in this reach, and one other is located just upstream of the crossing. (See Appendix C - Figure 16.)

3.2 Evaluation

Based on the visual inspection, Smith Pond Dam is in poor condition. Brush is growing on the crest of the dam. If it is allowed to continue growing, the crest will become covered with trees. If a tree then blows over and its roots are pulled out, or if a tree dies or is cut and its roots rot, serious seepage and erosion problems may result.

The one-foot-deep depression on the crest of the dam above the low-level outlet pipe is evidence of some past problem, which may have been overtopping, piping, or collapse of or leakage and piping into the low-level outlet pipe. The same problem may develop again and could lead to failure of the dam if remedial action is not taken. The concrete facing on the upstream face is in poor condition (poorly constructed).

Trees overhanging the downstream channel and logs and debris lying in the downstream channel could result in temporary damming of the channel during periods of floodflow.

If any of the trees growing immediately downstream of the dam blow over and pull out their roots, or if a tree dies or is cut down and its roots rot, seepage and erosion problems could result.

The footpath on the crest of all four dikes is devoid of vegetation and is consequently susceptible to erosion. Trees are growing on the crest, upstream face, and downstream face of all four dikes. If any of the trees blow over and pull out their roots, or if a tree dies or is cut down and its roots rot, seepage and erosion problems could result. Seepage noted at the downstream toe of two of the four dikes, if uncorrected, could lead to a stability problem in the future.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures

No written operational procedures exist for Smith Pond Dam. The flow through the spillway is not regulated and therefore discharge is controlled by the hydrologic characteristics of the drainage basin and through the partially open inoperable low-level gate. During periods of little rainfall, flow in the main channel is obstructed forcing water into the diversion channel to provide a water supply for the LaSalette Seminary.

4.2 Maintenance of Dam

LaSalette Seminary owns and is responsible for the maintenance of Smith Pond Dam.

4.3 Maintenance of Operating Facilities

Operating facilities are maintained by LaSalette Seminary. The gate is not operable and has not been so for many years.

4.4 Description of Any Warning System in Effect

No warning system or procedures were found for Smith Pond Dam.

4.5 Evaluation

Such operational and maintenance procedures that exist would not ensure that all problems could be remedied within a reasonable amount of time.

SECTION 5
HYDROLOGIC/HYDRAULIC

5.1 Evaluation of Features

a. General. Smith Pond Dam is a earth embankment dam placed between dry masonry walls. The upstream face has a crudely constructed concrete facing. The low-level outlet is inoperable. Four dikes, two east of the dam and two west of the dam, are required to contain the pond.

b. Design Data. No hydrologic or hydraulic design data were obtained.

c. Experience Data. No hydrologic or hydraulic experience data were disclosed.

d. Visual Inspection. At the time of inspection, no visual evidence was noted of damage to the dam caused by excessive discharge. The low-level gate, partially open, is inoperable.

e. Test Flood Analysis. Smith Pond Dam is classified as being small in size having a hydraulic height of 11 feet and a maximum storage capacity of [illegible] acre-feet. The dam was determined to have a Significant hazard classification. Using the Recommended Guidelines for Safety Inspection of Dams, the test flood was determined to be ½ the Probable Maximum Flood (PMF).

Using ½ the PMF, the test flood inflow for Smith Pond Dam having a drainage area of 0.9 square mile, was determined to be 1150 cfs. The test flood discharge after routing was calculated to be 1080 cfs, reflecting negligible surcharge storage effects on reducing peak inflows. The overtopping analysis indicates that the dam would be overtopped by approximately 1.4 feet during test flood conditions. The water depth discharging through the spillway, over the main dam, near easterly dike, far easterly dike, westerly dike, and far westerly dike would be 2.7 feet, 1.4 feet, 1.4 feet, 0.8 feet, 1.4 feet and 0.3 feet respectively. The spillway will pass 40 cfs or 4 percent of the test flood discharge. Therefore, the spillway is considered inadequate.

f. Dam Failure Analysis. The impact of failure of the dam at top of dam was assessed using Guidance for Estimating Downstream Dam Failure Hydrographs issued by the Corps of Engineers. The analysis covered the reach extending from the dam to Mascoma Lake, a distance of 1.4 miles. A major breach at top of dam would result in an increase in stage of 8.0 feet, above the antecedent stage of 3 feet, along the reach. A breach of the dam would increase the stage such that the depth of water flowing over State Route 4A would be about 3.2 feet. The total stage increase of 11 feet could cause appreciable property damage to State Route 4A and four inhabited structures resulting in the potential loss of 4-6 lives.

Additional property damage could result if the diversion tunnel capacity were to be exceeded and out-of-channel flow occurred. As a result of the analysis described above, the Smith Pond Dam was classified as Significant Hazard.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. The visual examination indicates the following evidence of potential problems:

(1) Seepage at the downstream toe of the two dikes that are east of the dam.

(2) Depression on the crest of the dam above the low-level outlet pipe.

(3) Lack of an operable low-level gate for the low-level conduit.

(4) Brush growing on the crest of the dam.

(5) Trees growing immediately downstream of the dam.

(6) Trees growing on the crest, upstream face, and downstream face of all four dikes.

(7) Lack of vegetation in the footpath on the crests of the four dikes.

b. Design and Construction Data. No design or construction data are available.

c. Operating Records. No operating records pertinent to the structural stability of the dam are available.

d. Post-Construction Changes. A letter dated December 6, 1972 indicates that "the dam was reconstructed in 1947". The reconstruction may have included the construction of the concrete facing on the upstream side of the dam.

e. Seismic Stability. This dam is located in Seismic Zone 2 and in accordance with the Phase I guidelines does not warrant seismic analysis.

SECTION 7
ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. The visual examination indicates that Smith Pond Dam is in poor condition. The major concerns with respect to the integrity of the dam if left uncorrected are:

(1) The inadequately sized spillway.

(2) The lack of an operable low-level gate for the low-level conduit.

(3) Depression on the crest of the dam above the low-level outlet pipe.

(4) Seepage at the downstream toe of the two dikes that are east of the dam.

(5) Brush growing on the crest of the dam.

(6) Trees growing immediately downstream of the dam.

(7) Trees growing on the crest, upstream face, and downstream face of all four dikes.

(8) Lack of vegetation in the footpath on the crests of the four dikes.

b. Adequacy of Information. The information available is such that the assessment of this dam must be based primarily on the results of the visual inspection.

c. Urgency. The recommendations made in 7.2 and 7.3 should be implemented by the owner within one year after receipt of this Phase I report.

d. Need for Additional Information. There is no need for additional information to complete this Phase I investigation.

7.2 Recommendations

The owner should engage a Registered Professional Engineer to:

a. Design and construct additional spillway capacity.

b. Investigate the depression on the crest of the dam above the low-level outlet pipe, and design and implement necessary remedial repairs.

c. Design and supervise procedures for clearing trees and brush and root systems from the crest of the dam, and from the crest, upstream and downstream slope of the four dikes.

d. Investigate the seepage which is occurring at the downstream toe of the two dikes east of the dam, and design and implement necessary remedial measures.

e. Design and supervise procedures for restoring control of the low-level outlet.

7.3 Remedial Measures

a. Operating and Maintenance Procedures. The owner should:

(1) Maintain clearance of all trees and brush from the area within 25 feet downstream from the toes of the dam and dikes.

(2) Remove the debris from the overflow spillway channel.

(3) Remove trees and brush from the channel downstream of the dam for a distance of 25 feet on either side of the channel within 100 feet of the toe of the dam.

(4) Prevent trespassing on the crest of the four dikes and reestablish grassy vegetation in the existing footpath on the dikes.

(5) Monitor the seepage regularly each month and continue to watch for new seepages that may occur.

(6) Visually inspect the dam and appurtenant structures once each month.

(7) Engage a Registered Professional Engineer to make a comprehensive technical inspection of the dam once each year.

(8) Establish a surveillance program for use during and immediately after heavy rainfall and also a warning program to follow in case of emergency conditions.

7.4 Alternatives

None recommended.

APPENDIX A

VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST
PARTY ORGANIZATION

PROJECT Smith Pond Dam, N. H.

DATE May 9, 1979

TIME 0930

WEATHER Sunny, warm

W.S. ELEV.	U.S.	DN.S.
	1650	1640.9

PARTY:

1. Warren Guinan
2. Stephen Gilman
3. Gerry Blanchette
4. Robert Ojendyk
5. Leslie Williams
6. Ronald Hirschfeld
7. Pattu Kesavan
8. Brother Claude Rheaume
9.
10.

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	Hydrology/Hydraulics	W. Guinan/L. Williams	
2.	Structural Stability	S. Gilman/G. Blanchette	
3.	Soils and Geology	R. Hirschfeld	
4.			
5.			
6.			
7.			
8.			
9.			
10.			

PERIODIC INSPECTION CHECKLIST

PROJECT Smith Pond Dam, N. H. DATE May 9, 1979

PROJECT FEATURE Dam Embankment NAME ______

DISCIPLINE ______ NAME ______

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	1651.3' MSL (low point)
Current Pool Elevation	1650' MSL
Maximum Impoundment to Date	
Surface Cracks	Sinkhole in crest immediately downstream of masonry upstream face and above low-level outlet.
Pavement Condition	Not paved
Movement or Settlement of Crest	See "Surface Cracks" above.
Lateral Movement	None apparent
Vertical Alignment	See "Surface Cracks" above.
Horizontal Alignment	Fair
Condition at Abutment and at Concrete Structures	Good
Indications of Movement of Structural Items on Slopes	None apparent
Trespassing on Slopes	None apparent
Sloughing or Erosion of Slopes or Abutments	None apparent
Rock Slope Protection - Riprap Failures	No riprap
Unusual Movement or Cracking at or Near Toe	None apparent
Unusual Embankment or Down-stream Seepage	None apparent
Piping or Boils	None apparent
Foundation Drainage Features	None apparent
Toe Drains	None apparent
Instrumentation System	None apparent
Vegetation	Trees and brush on crest

PERIODIC INSPECTION CHECKLIST

PROJECT Smith Pond Dam, N. H. DATE May 9, 1979

PROJECT FEATURE East Dikes NAME

DISCIPLINE NAME

AREA EVALUATED	CONDITION Near East Dike	CONDITION Far East Dike
DIKE EMBANKMENT		
Crest Elevation	1651.3	1651.9
Current Pool Elevation	1650	1650
Maximum Impoundment to Date	Unknown	Unknown
Surface Cracks	None apparent	None apparent
Pavement Condition	Not paved	Not paved
Movement or Settlement of Crest	None apparent	None apparent
Lateral Movement	None apparent	None apparent
Vertical Alignment	Good	Good
Horizontal Alignment	Good	Good
Condition at Abutment and at Concrete Structures	Good	Good
Indications of Movement of Structural Items on Slopes	None apparent	None apparent
Trespassing on Slopes	Footpath on crest	Footpath on crest
Sloughing or Erosion of Slopes or Abutments	None apparent	None apparent
Rock Slope Protection - Riprap Failures	None apparent	None apparent
Unusual Movement or Cracking at or Near Toes	None apparent	None apparent
Unusual Embankment or Downstream Seepage	Major seepage at downstream toe - estimated 2-3 cfs	Minor seepage downstream of toe
Piping or Boils	None apparent	None apparent
Foundation Drainage Features	None apparent	None apparent
Toe Drains	None apparent	None apparent
Instrumentation System	None apparent	None apparent
Vegetation	Large trees	Many trees

PERIODIC INSPECTION CHECKLIST

PROJECT Smith Pond Dam, N. H. DATE May 9, 1979

PROJECT FEATURE West Dikes NAME

DISCIPLINE NAME

AREA EVALUATED	CONDITION Near West Dike	CONDITION Far West Dike
DIKE EMBANKMENT		
Crest Elevation	1651.3	1652.4
Current Pool Elevation	1650	1650
Maximum Impoundment to Date	Unknown	Unknown
Surface Cracks	None apparent	None apparent
Pavement Condition	Not paved	Not paved
Movement or Settlement of Crest	None apparent	None apparent
Lateral Movement	None apparent	None apparent
Vertical Alignment	Good	Good
Horizontal Alignment	Good	Good
Condition at Abutment and at Concrete Structures	Good	Good
Indications of Movement of Structural Items on Slopes	None apparent	None apparent
Trespassing on Slopes	Footpath on crest	Footpath on crest
Sloughing or Erosion of Slopes or Abutments	None apparent	None apparent
Rock Slope Protection - Riprap Failures	None apparent	None apparent
Unusual Movement or Cracking at or Near Toes	None apparent	None apparent
Unusual Embankment or Downstream Seepage	None apparent	None apparent
Piping or Boils	None apparent	None apparent
Foundation Drainage Features	None apparent	None apparent
Toe Drains	None apparent	None apparent
Instrumentation System	None apparent	None apparent
Vegetation	Trees & brush	Trees & brush

PERIODIC INSPECTION CHECKLIST

PROJECT Smith Pond Dam, N. H. DATE May 9, 1979

PROJECT FEATURE Spillway NAME

DISCIPLINE NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	Good
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Approach Channel	Bedrock and boulders
b. Weir and Training Walls	
General Condition of Concrete	
Rust or Staining	
Spalling	
Any Visible Reinforcing	
Any Seepage or Efflorescence	
Drain Holes	None
c. Discharge Channel	
General Condition	Poor
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	Many overhanging
Floor of Channel	Bedrock
Other Obstructions	Logs across channel

PROJECT Smith Pond Dam, N. H. | DATE May 9, 1979

PROJECT FEATURE Reservoir | NAME L. Williams

AREA EVALUATED	REMARKS
Stability of Shoreline	Good
Sedimentation	None observed
Changes in Watershed Runoff Potential	None
Upstream Hazards	None
Downstream Hazards	State Route 4A and 4 houses 1.4 miles downstream.
Alert Facilities	None observed
Hydrometeorological Gages	None
Operational & Maintenance Regulations	None posted

APPENDIX B

ENGINEERING DATA

State of New Hampshire
WATER RESOURCES BOARD
37 Pleasant Street
Concord, N.H. 03301
TELEPHONE 271-3406

June 27, 1978

Lasallette Seminary
Route 4A
Enfield, New Hampshire 03748

Re: Smith Pond Channel, Enfield, No. 77.12

Gentlemen:

At the request of the New Hampshire Public Works and Highway Department and property owners to investigate and suggest a solution to the problem which occurs during high water every year along the Channel flowing from the Smith Pond, an engineer made an inspection of the area on June 14, 1978.

Brother Claude Rheaume of the Seminary, Dick Heath, Wilmot Estey of the Highway Department and Allen Nickerson (property owner) were present during the inspection.

Walking along the Channel the engineer found that the Channel flowing from the Smith Pond was very shallow due to the sand, gravel and silt rolling in and filling it. Also, at every ten or fifteen feet intervals, the trees' trunks have narrowed the channels to such a degree that every fall and winter the leaves and snow blocked these bottlenecks and caused the water to flow over the banks, run along the field and occasionally flooded the highway (Route 4A).

The culverts under Route 4A in this area are not designed to take this discharge and hence the water has flowed over the roads causing a menace situation to the motorists. The same situation upstream has caused problems at the trailor park and Mr. Bassey who lives in this area has complained to us in the past.

The engineer suggests the following:

1- The Highway Department could increase the culvert sizes to flow the occasional discharges from the Channel. This still would not solve the problem at the trailor park. Moreover, the Highway Department is not obligated to increase the sizes of the culvert more than the design required. Cost of the replacement will also be high. Therefore, this suggestion should be taken into account only as a last solution.

2- It is recommended that the Seminary should excavate the Channel about two miles where it branches off from the main Channel and cut all the trees which are obstructing the flow. This would definitely solve the problem and if the Channel is properly maintained there should not be any flooding occurring in the future also.

June 27, 1978

Lasallette Seminary

As a conclusion we suggest that the second solution should be carried out by the Seminary who is the responsible owner of the Smith Pond and the Channel.

If you have any questions please write or call us.

Sincerely,

George McGee Sr.

George M. McGee, Sr.,
Chairman

GMM:PK:paf
cc: Dick Heath
Harvey Bassey
Allen Nickerson

NEW HAMPSHIRE WATER RESOURCES BOARD

INSPECTION REPORT

Town: Enfield Dam Number: 77.12

Name of Dam, Stream and/or Water Body: Smith Pond

Owner: La Salette Seminary Telephone Number:

Mailing Address:

Max. Height of Dam: 8' Pond Area: 96 A Length of Dam: 100'

FOUNDATION: Ledge

OUTLET WORKS: Gate inoperative Size unknown

Concrete overflow 28" wide 1' deep

ABUTMENTS:

EMBANKMENT: Concrete upstream Face Dry Stone downstream

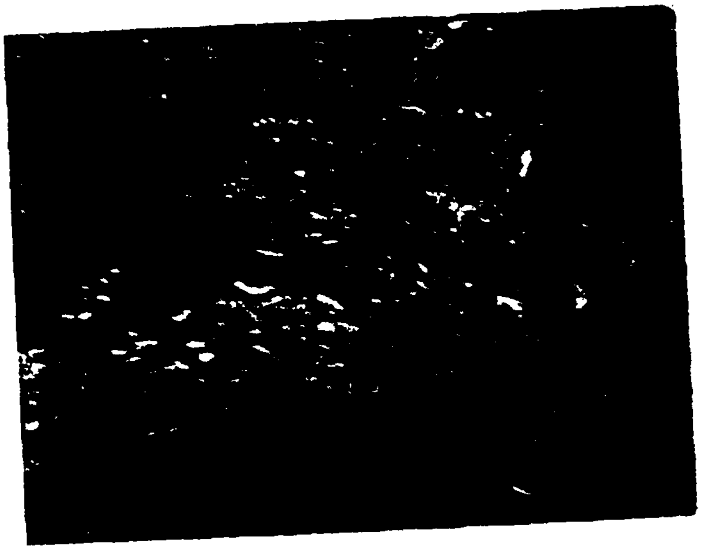
15' wide top covered with trees

Note: Give Sizing, Condition and detailed description for each item, if applicable.

Dam No.________

COMMENTS: Gate section should be repaired
Trees should cut Trash should be removed from spillway

#1



#2

SPILLWAY: Length: 28" Freeboard: 1'

SEEPAGE: Location, estimated quantity, etc.

Changes Since Construction or Last Inspection:

Tail Water Conditions:

Overall Condition of Dam: Fair

Contact With Owner: No

Date of Inspection: 1 June 77 Suggested Reinspection Date

Class of Dam: menace

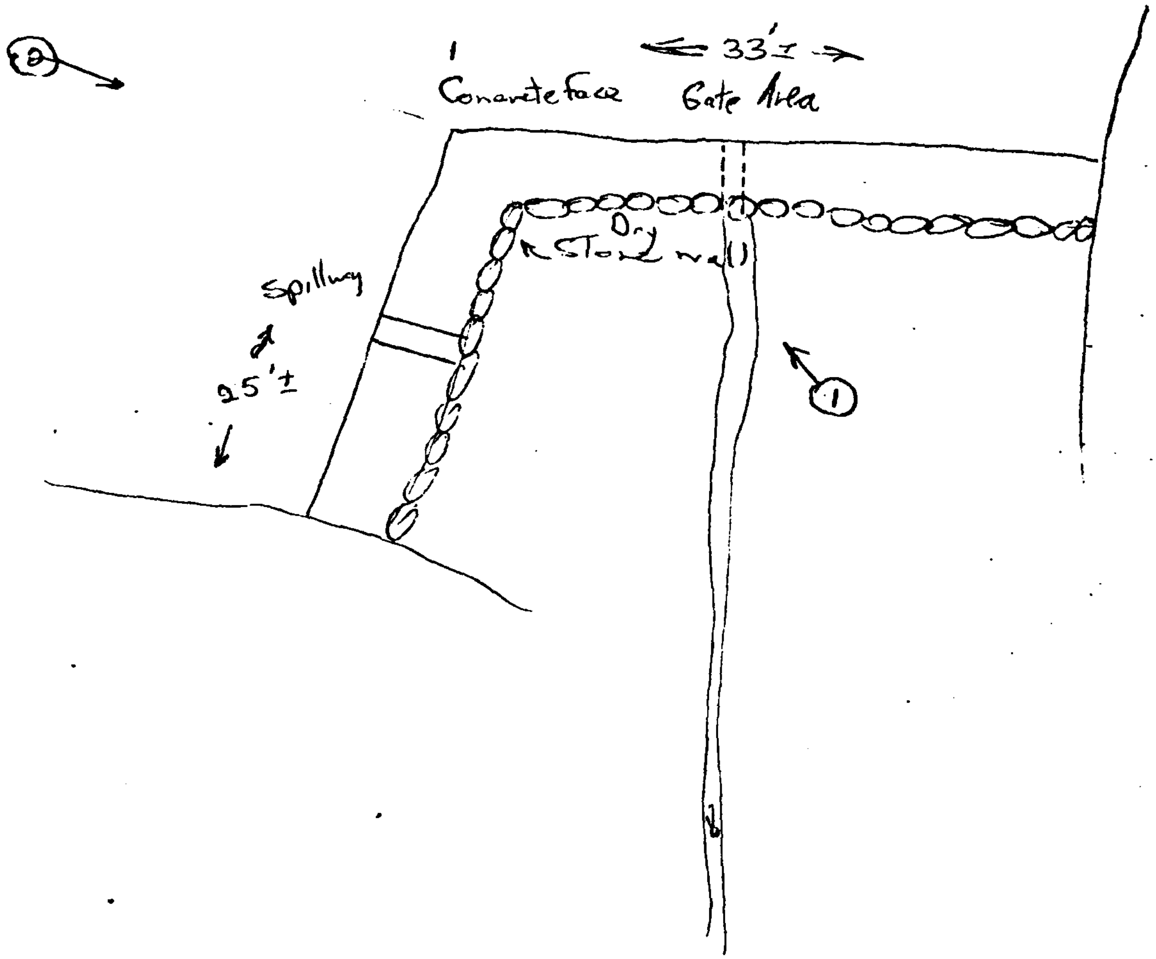
Signature Steph C Burritt

Date

Note: Give Sizing, Condition and detailed description for each item, if applicable.

Dam No.______________

SKETCH OF DAM (Show Plan, Elevation & Cross Sections)



NEW HAMPSHIRE
WATER RESOURCES BOARD

SITE EVALUATION DATA

OWNER: La Salette Seminary TELEPHONE NO. ____

MAILING ADDRESS: Endfield NH

SITE LOCATION (TOWN OR CITY) Endfield

NAME OF STREAM OR WATERBODY: Smith Pond

QUADRANGLE: ____ LOCATION ____

HEIGHT OF (PROPOSED, EXISTING) DAM 8' LENGTH 100'

TYPE OF (PROPOSED, EXISTING) STRUCTURE Concrete old stone rubble stone wall

DRAINAGE AREA 1.05 SM POND AREA 96

AVAILABLE ARTIFICIAL STORAGE: PERMANENT: ____ TEMPORARY: ____ TOTAL 1100 AF

EXISTING DEVELOPMENT DOWNSTREAM OF (PROPOSED, EXISTING) STRUCTURE

Some Blds Rte 4A

POTENTIAL DEVELOPMENT DOWNSTREAM OF (PROPOSED, EXISTING) STRUCTURE ____

POTENTIAL DAMAGE DOWNSTREAM OF STRUCTURE (EXPLAIN IN DETAIL AND INCLUDE ANY POTENTIAL LOSS OF LIFE ESTIMATE) Wash out of Rte 4A possable damage to Blds

OTHER COMMENTS: ____

CLASS OF STRUCTURE --- [redacted]: MENACE B DAM # 77.12

DATE OF INSPECTION: 1 June 77

B-7 SIGNED S B [illegible]

SIGNATURE

DATE:

M E M O R A N D U M

DATE: May 25, 1973

FROM: Pattu D. Kesavan, Water Resources Engineer

SUBJECT: Smith Pond, Enfield - #77.12

TO: Vernon A. Knowlton,
Chief Engineer, Water Resources Board

On May 2, 1973, I inspected the Smith Pond dam in Enfield. Brother Richard Dionne of LaSalette Seminary accompanied me during my inspection.

This 96-acre Smith Pond has a 65-ft. long, 8-ft. deep, 15 1/2 ft. wide dam at its outlet. The Seminary uses this water for drinking purposes. About 1 1/4 mile downstream of this dam is Rte. 4-A, and the drop in elevation between these two points is about 650 feet.

This will be classified as a menace dam. Plans and completed "Statement of Intent" forms are filed in Enfield dam file #77.12.

PDK:js

THE STATE OF NEW HAMPSHIRE

County of Grafton ss. May 9 1973

STATEMENT OF INTENT TO ~~CONSTRUCT~~ OR

~~RECONSTRUCT~~ A DAM AT Smith's Pond

TO THE WATER RESOURCES BOARD:

RECEIVED

WATER RESOURCES BOARD

In compliance with the provisions of RSA 482:3.

We,
I, La Salette Seminary Corporation
(Here state name of person or persons, partnership, association, corporation,

etc.)

hereby state our intent to the Water Resources Board to ~~construct~~, to ~~reconstruct~~, ~~to make repairs~~ to, a dam along, or (cross out portion not applicable) across:
to continue using

Smith's Pond
(Here state name of stream or body of water)

At a point East end of Smith's Pond approx.
(Here give location, by distance from mouth of stream, county or

2 miles from La Salette Seminary
municipal boundary)

in the town (s) of Enfield

in accordance with PRELIMINARY PLANS, and SPECIFICATIONS FILED WITH THIS STATEMENT AND MADE A PART HEREOF.

We,
I, understand that more detailed plan and specifications may be requested by the Board in conformance with RSA 482:4 and that, if such plans are requested, construction will not commence until such plans have been filed with and approved by the Board.

The purpose of the proposed construction is for drinking
(Here briefly state use to which stored water is to be put)

kitchen, toilets, fire hydrants,

irrigation for gardens

The construction will consist of 65 feet long
(Here give brief description of work contemplated including height of dam)

8 feet deep, ~~to~~ 15½ feet wide

All land to be flowed ~~is~~ is not owned by applicant.

Brother Richard Dionne
La Salette Seminary

Address Rte 4A
Enfield, N.H. 03748

Note: This statement together with plans, specifications and information and data filed in connection herewith will remain on file in the office of the Water Resources Board. This statement is to be filed in duplicate.

All other information is already in your files.

DATE: December 11, 1972

FROM: Pattu D. Kesavan, Water Resources Engineer

SUBJECT: Smith Pond, Enfield, N.H.

TO: Vernon A. Knowlton, Chief Water Resources Engineer

Based on the Special Forestry Program's letter of February 29, 1972, I went to Enfield on November 27, 1972, to inspect the illegal dam at the outlet of Smith Pond.

Due to the weather conditions, I was unable to get to the site, but I gathered some information from the Town Clerk. LaSalette Seminary, Enfield, bought this dam from Shakers who might have built the dam in the late 1800's. Referring to our old town blueprints, this present Smith Pond is shown as three small ponds called lily ponds, and are approximately six to seven acres each in area.

In my opinion, these three ponds were impounded together when the dam was built in the late 1800's and became one large pond, known as Smith Pond. The latest data available on the Smith Pond indicates that this is a natural pond raised by damming with an area of 96 acres. Maximum depth sounded 36 feet and average depth 11 feet.

PDK/js

La Salette Seminary
Enfield, N. H. 03748

RECEIVED
DEC 8 1972
NEW HAMPSHIRE
WATER RESOURCES BOARD

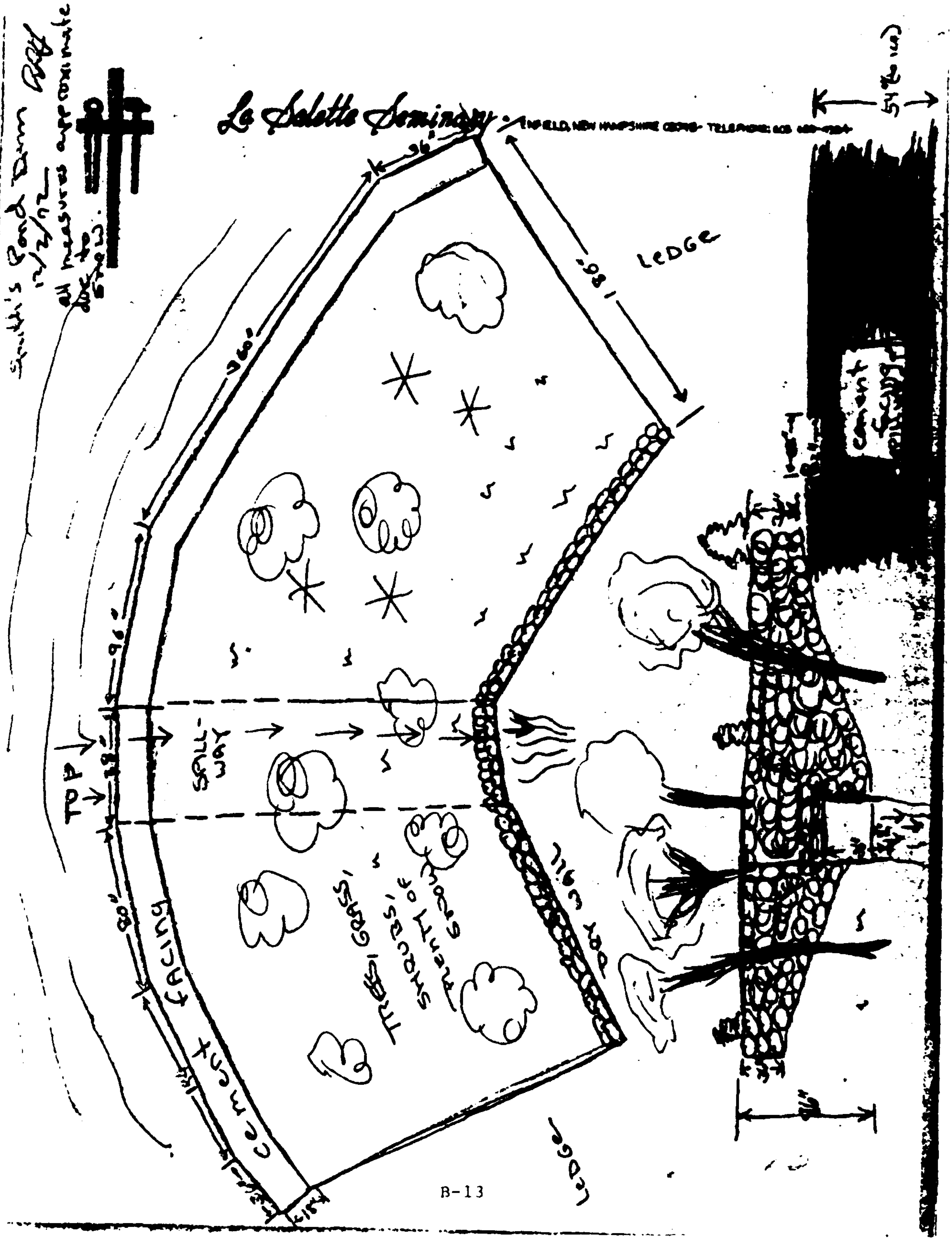
December 6, 1972

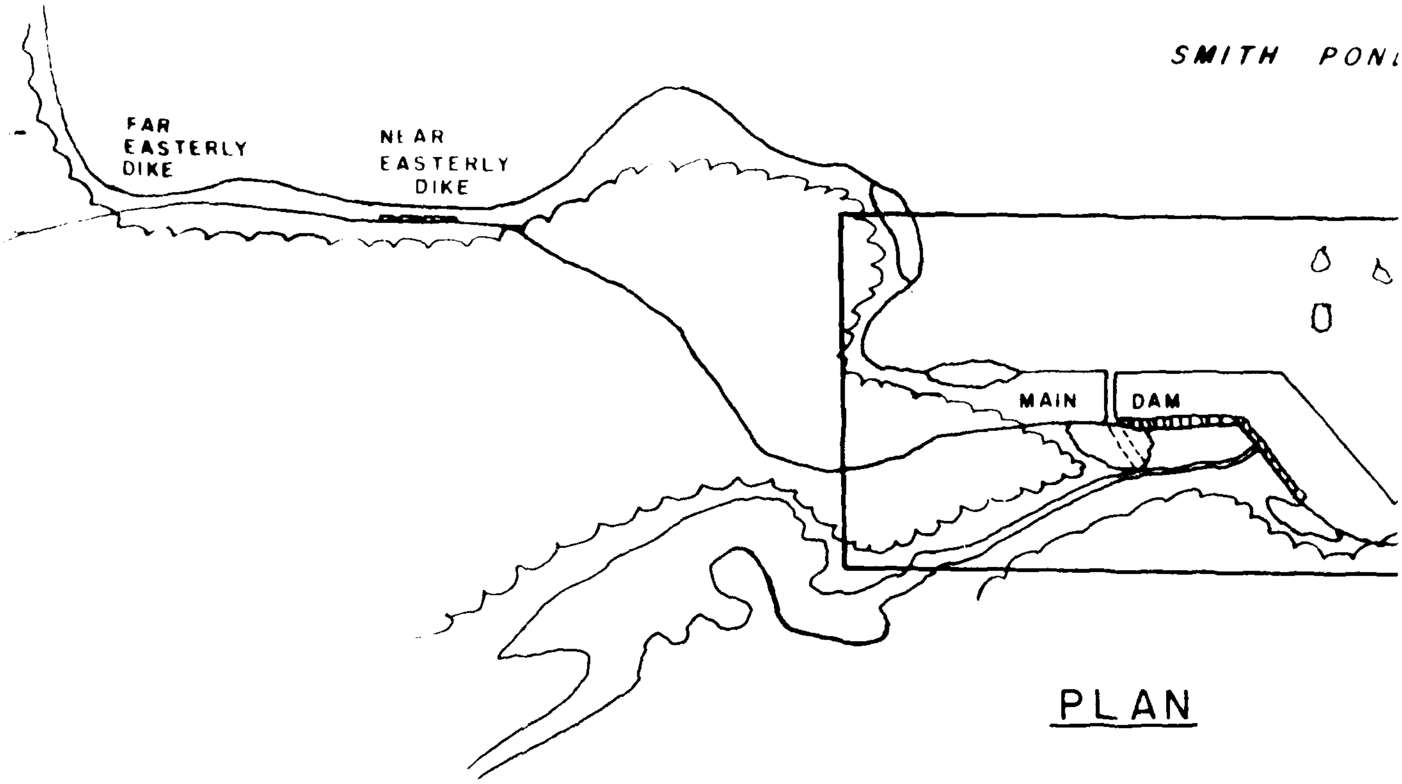
Dear Sir,

Here are a few photoes and a basic diagram of the dam we have on Smith's Pond. The winter conditions being what they are, we could not get very accurate measurements of the dam. When the dam was reconstructed in 1947 there were no plans made so we cannot tell you the exact measurements now. We do have written information concerning the history of the pond since 1835, but at no time have the original owners, or the Shakers, or ourselves taken the pains of assuring ourselves that the dam is architecturally safe. Your concern is appreciated and we hope that you let us know if we can be of more assistance. Thank you.

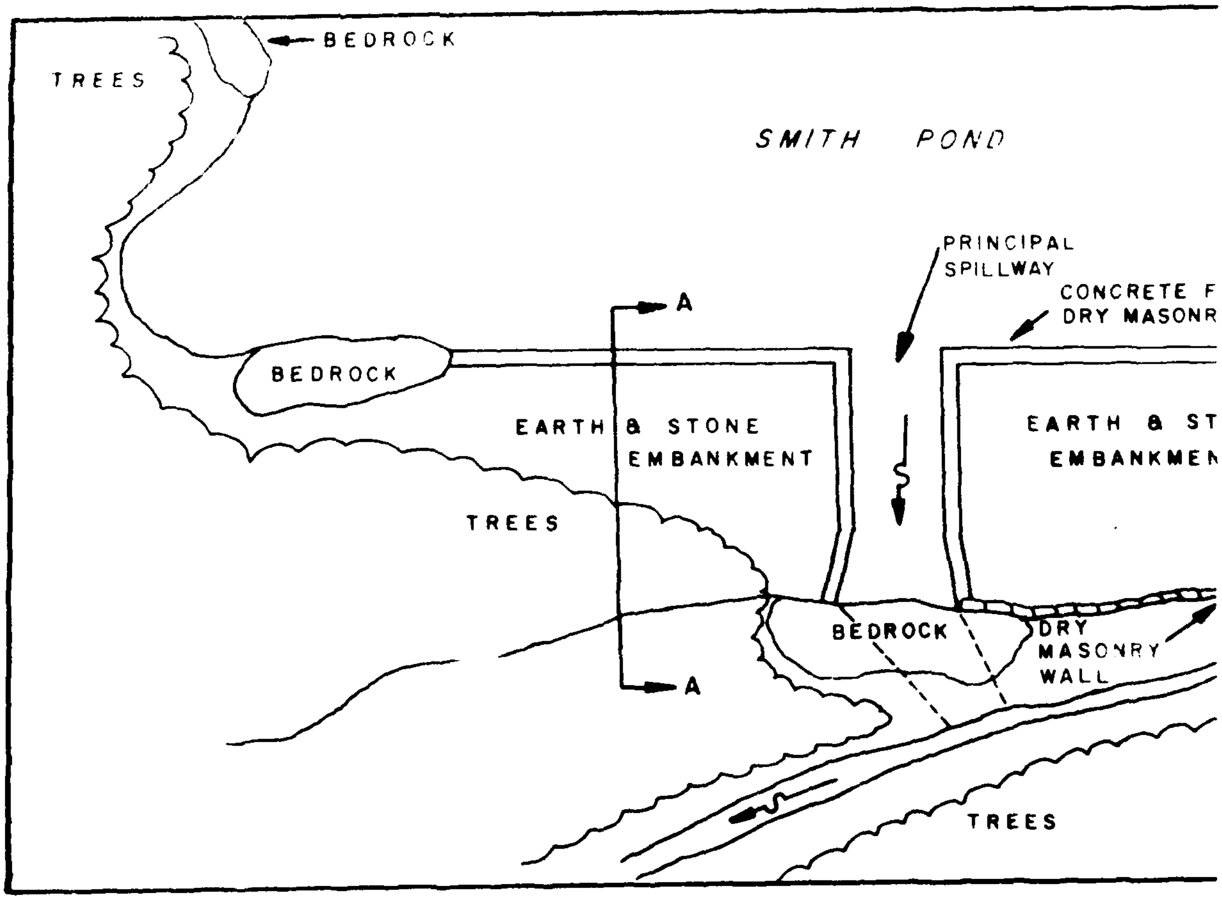
Sincerely yours,

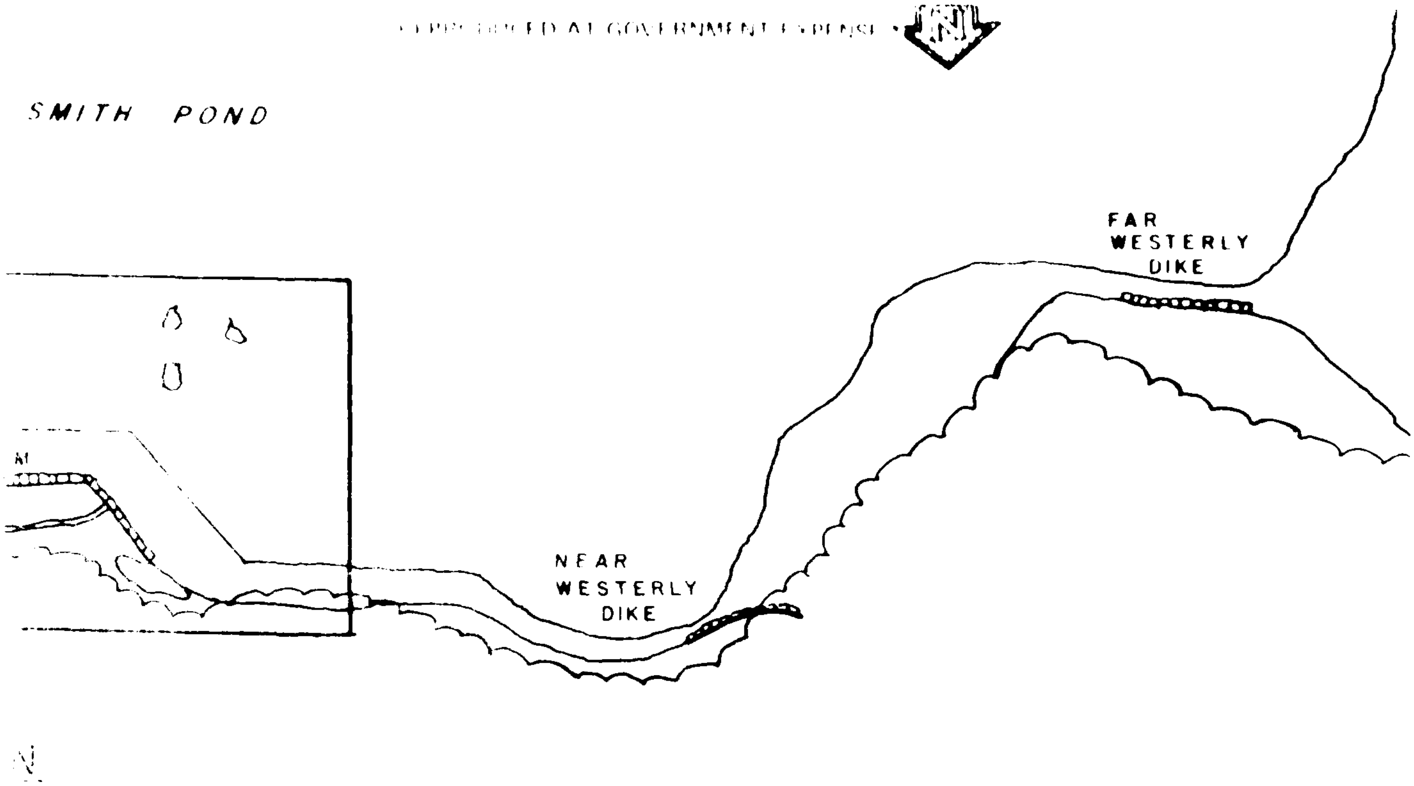
Brother Richard Dionne

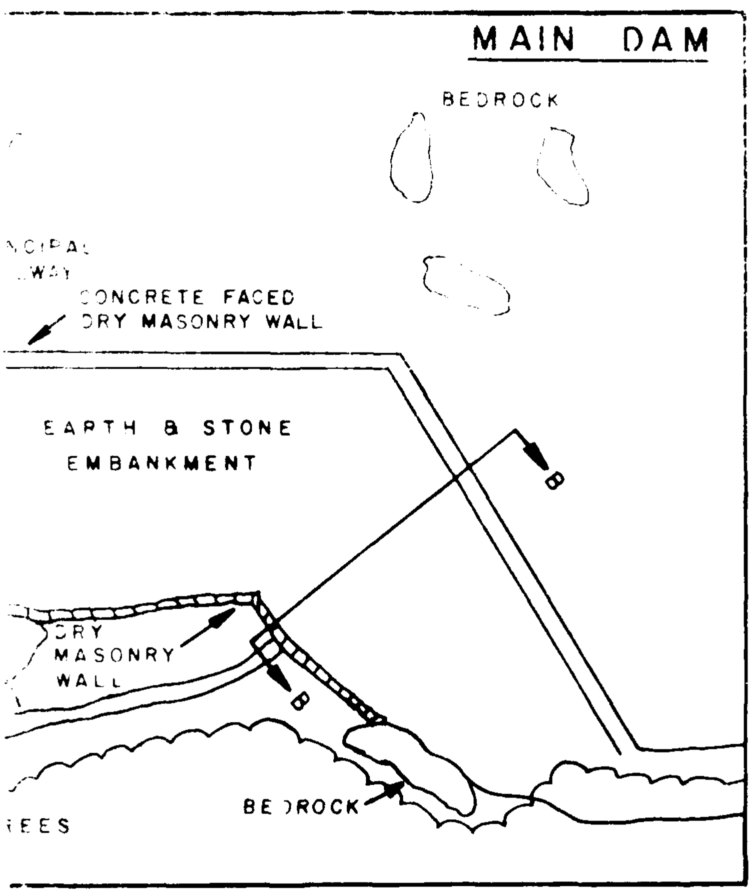

La Salette Seminary
Smith's Pond Dam
all measures approximate
LEDGE
180'
96'
360'
96'
18'
TOP
SPILL-WAY
80'
CEMENT FACING
TREES, GRASS, SHRUBS, PLENTY OF MOSS
DRY WALL
LEDGE
Cement Facing


SMITH PON
FAR EASTERLY DIKE
NEAR EASTERLY DIKE
MAIN
DAM

PLAN


BEDROCK
TREES
SMITH POND
PRINCIPAL SPILLWAY
CONCRETE F
DRY MASONR
A
BEDROCK
EARTH & STONE EMBANKMENT
EARTH & ST
EMBANKMEN
TREES
BEDROCK
DRY MASONRY WALL
A
TREES





Anderson-Nichols & Co., Inc. CONCORD NEW HAMPSHIRE	U.S. ARMY ENGINEER D CORPS OF ENG WALTHAM, M

NATIONAL PROGRAM OF INSPECTION OF NO

SMITH POND DAM

SMITH POND NEW H

			SCALE: NOT TO SCALE
			DATE: JULY, 1979

Anderson-Nichols & Co., Inc. CONCORD NEW HAMPSHIRE	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

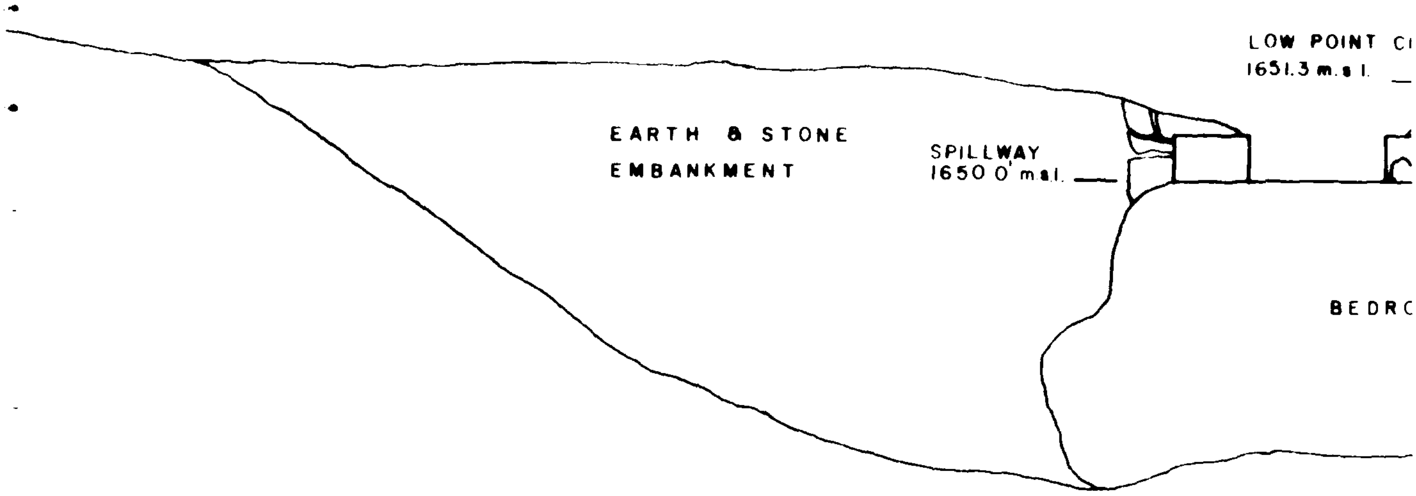
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

SMITH POND DAM

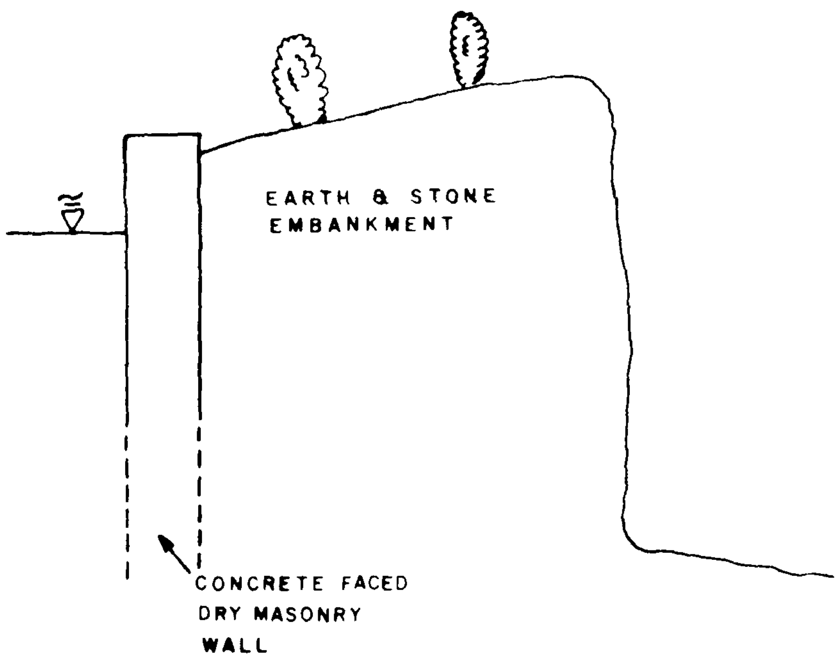
SMITH POND NEW HAMPSHIRE

SCALE: NOT TO SCALE

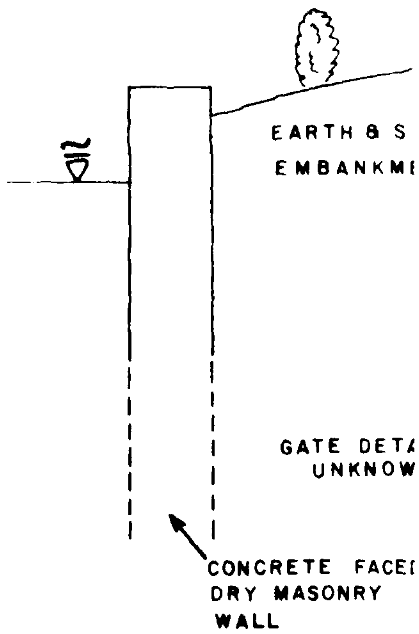
DATE: JULY, 1979



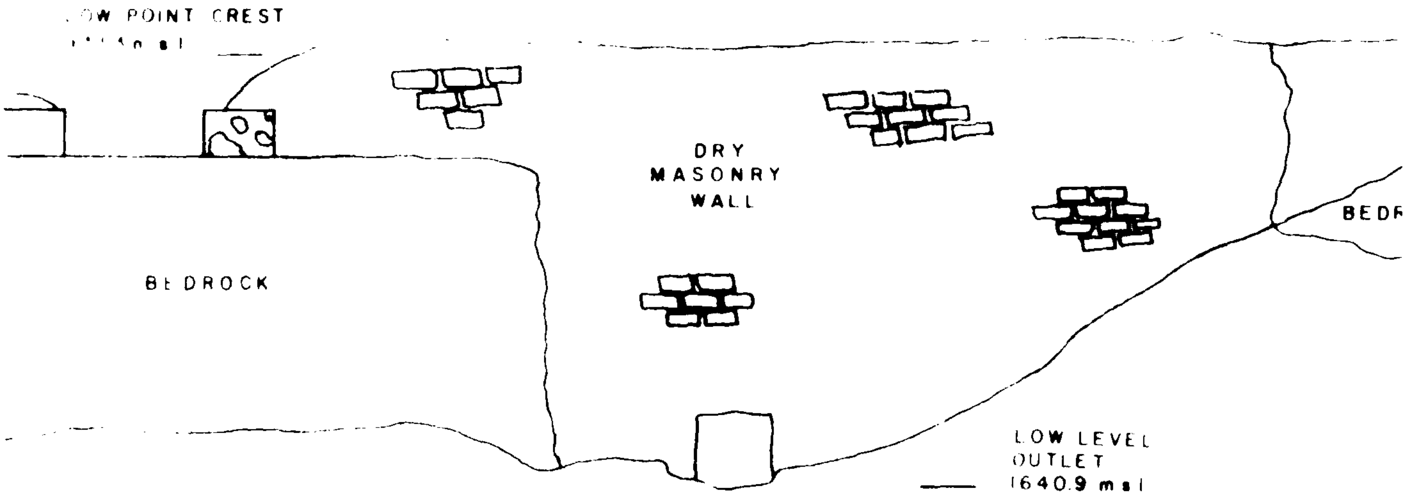
ELEV



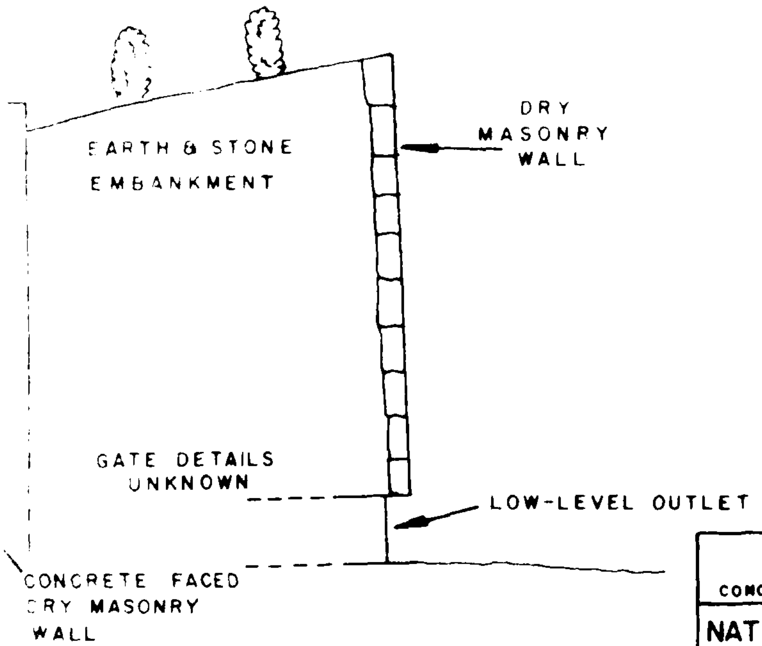
SECTION A-A



SECTI



ELEVATION



SECTION B-B

Anderson-Nichols & Co., Inc. CONCORD NEW HAMPSHIRE	U.S. ARMY ENGINEER DIV. NEW E CORPS OF ENGINEERS WALTHAM, MASS.

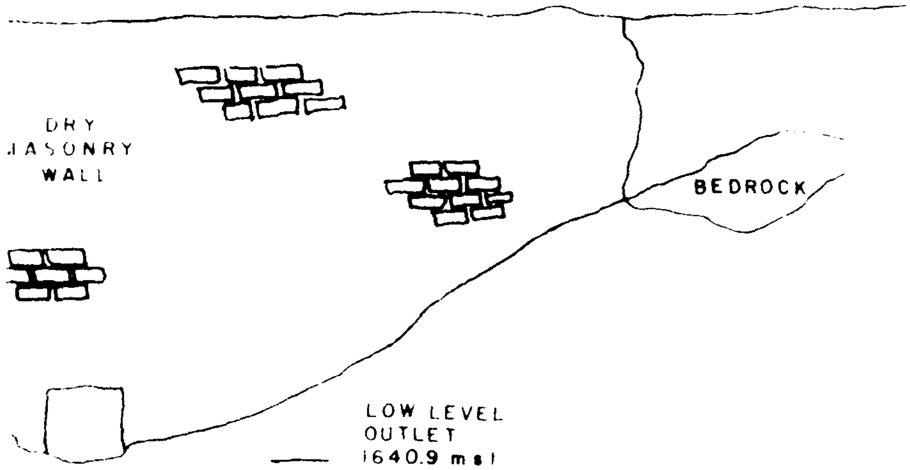
NATIONAL PROGRAM OF INSPECTION OF NON-FED.

SMITH POND DAM

SMITH POND — NEW HAMPSHI

SCALE NOT TO SCALE

DATE JULY, 1979

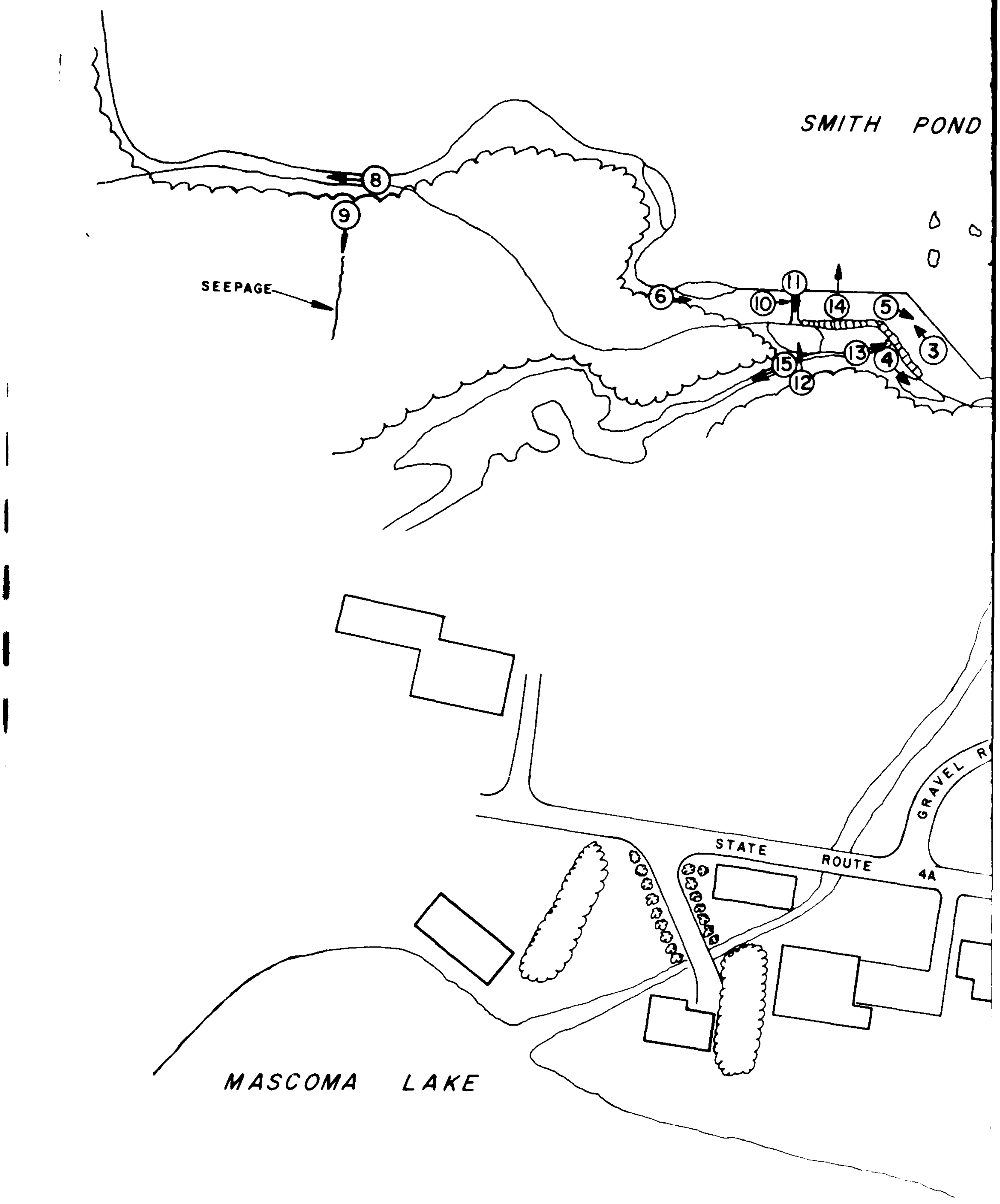


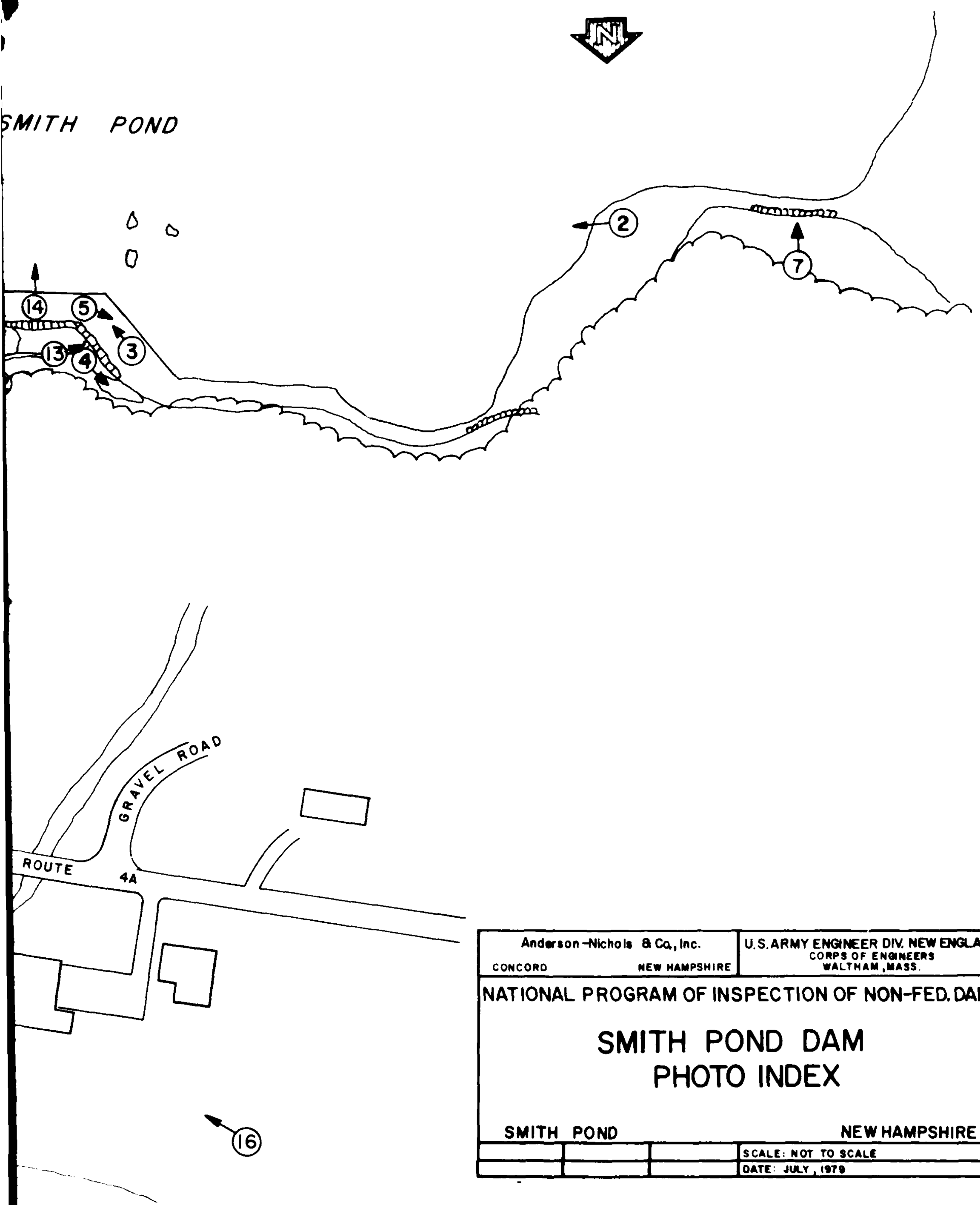
UTLET

Anderson-Nichols & Co., Inc. CONCORD NEW HAMPSHIRE		U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS	
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS			
SMITH POND DAM			
SMITH POND		NEW HAMPSHIRE	
			SCALE NOT TO SCALE
			DATE JULY, 1979

APPENDIX C

PHOTOGRAPHS


SMITH POND
8
9
SEEPAGE
6
11
10
14
5
3
13
4
15
12
GRAVEL R
STATE ROUTE 4A
MASCOMA LAKE



Anderson-Nichols & Co., Inc. CONCORD NEW HAMPSHIRE	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

SMITH POND DAM
PHOTO INDEX

SMITH POND NEW HAMPSHIRE

			SCALE: NOT TO SCALE
			DATE: JULY, 1979

May 9, 1979

Figure 2 - Looking at upstream face of the dam from the west bank of the pond.

May 9, 1979

Figure 3 - Looking eastward along crest of main dam from the west abutment. Note irregularity of concrete facing.

May 9, 1979

Figure 4 - Looking westward along the downstream face of the dam.

May 9, 1979

Figure 5 - Looking at the depression in which a rubble-type of fill is exposed. This depression is located directly above the low-level outlet.

May 9, 1979

Figure 6 - Looking west along crest of main dam. Note the brush and saplings growing on the crest of the dam.

May 9, 1979

Figure 7 - Looking at downstream face of the farther westerly dike.

May 9, 1979

Figure 8 - Looking eastward along crest of the first easterly dike.

May 9, 1979

Figure 9 - Seepage downstream from the dike shown in Figure 8.

May 9, 1979

Figure 10 - View of entrance to spillway channel. Note debris.

May 9, 1979

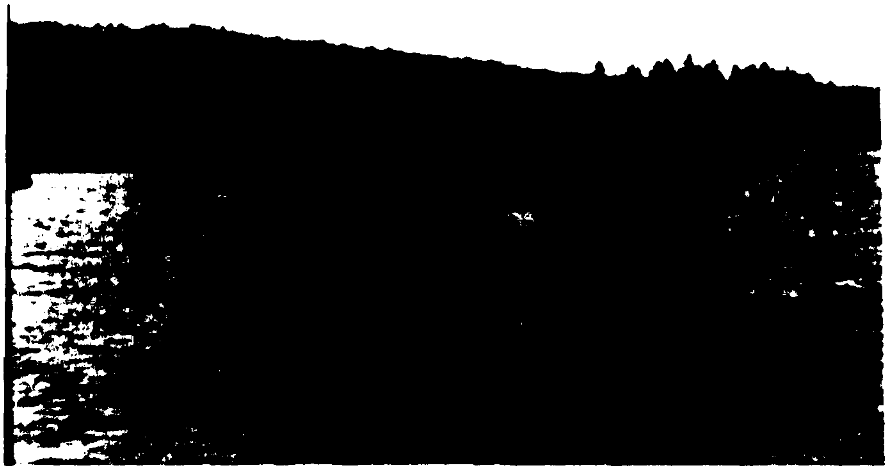
Figure 11 - Looking downstream along spillway channel across crest.

May 9, 1979

Figure 12 - Looking at spillway discharge channel. Note the exposed bedrock.

May 9, 1979

Figure 13 - View of the low-level outlet.



May 9, 1979

Figure 14 - Looking upstream into the reservoir from the main dam.

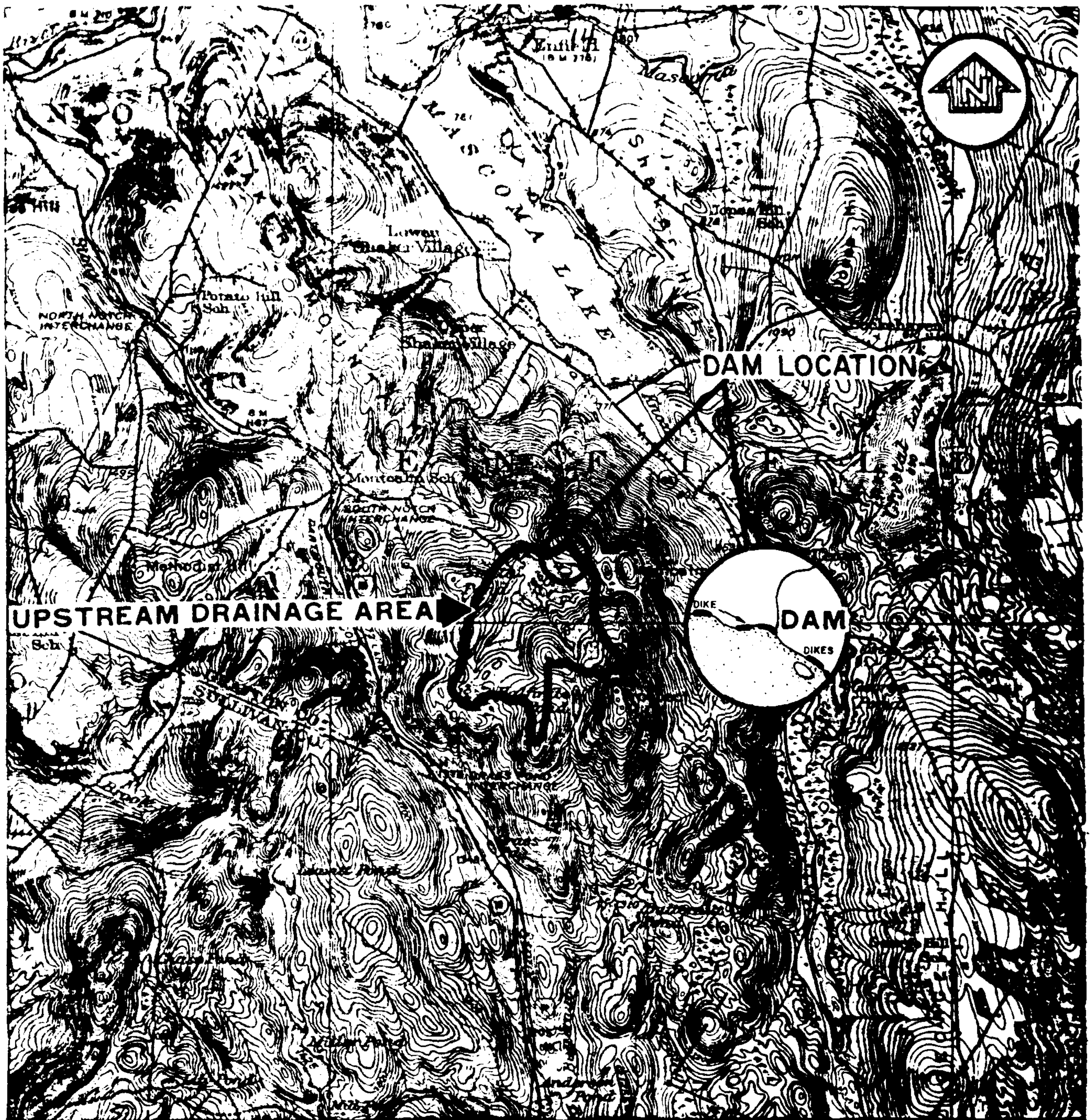
May 9, 1979

Figure 15 - Looking at downstream channel of spillway and low-level outlet.

Figure 16 - Overview of downstream hazard area. Structure upstream of road crossing is located just off photo at right side.

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS



NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

SMITH POND DAM
ENFIELD, NEW HAMPSHIRE

REGIONAL VICINITY MAP

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

ANDERSON-NICHOLS & CO., INC. CONCORD, NH

SCALE IN MILES

1 ½ 0 1 2

MAP BASED ON U.S.G.S. 15 MINUTE QUADRANGLE SHEET. MASCOMA, N.H., VT. 1927.

HYDROLOGY / HYDRAULICS
SMITH POND DAM

Drainage Area = 0.9 mi²
Size Classification = Small
Hazard Classification = Significant
Test Flood = ½ PMF

Step #1 Calculate PMF using "Preliminary Guidance for Estimating Maximum Probable Discharge in Phase I Dam Safety Investigations, March 1978."

Slope of watershed is about 290 ft/mi. Therefore the mountainous curve will be used. Using Recommended Guidelines for DA's less than 2 mi², a csm value of 2550 will be applied to Smith Pond Dam:

$$2550 \text{ csm} \times 0.9 \text{ mi}^2 = 2300 \text{ cfs } (Q_{p_1})$$

$$\tfrac{1}{2} Q_{p_1} = \text{Test Flood Inflow} = 1150 \text{ cfs}$$

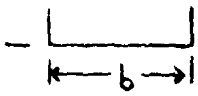
Step #2 a. Determine Surcharge Height to pass Q_p of 2300 cfs. To do this a the rating curve must be calculated for Smith Pond Dam. Outflow would occur at five separate areas: (1) the principal spillway, (2) the main dam embankment, including the westerly dike; (3) the easterly dike; (4) the farther easterly dike; and (5) the farther westerly dike. The following is an analysis of the above.

Since the downstream channel is steep - $\frac{1650-[illegible]}{.6(5280)}$ = .14 ft/ft or 14% - flow downstream will probably be supercritical. Since flow in Smith Pond is like a lake (subcritical), the hydraulic control must be critical depth for low discharges occuring at the spillway. All discharges over the embankment are best computed using the weir formula $Q = CLH^{3/2}$

(1) Principal Spillway - concrete. A weir section across this outlet is shown on page 4. Determine a discharge curve to find critical depth.

Trial No.	Critical Depth (d_c) (ft.)	Elevation	Q_c (cfs)
1	0	1650.0	0
2	0.3	1650.3	5
3	0.4	1650.4	7
4	0.5	1650.5	9
5	0.6	1650.6	12
6	0.7	1650.7	16
7	0.8	1650.8	19
8	0.9	1650.9	23
9	1.0	1651.0	27
10	1.1	1651.1	31
11	1.3	1651.3	40
12	1.9	1651.9	70
13	2.4	1652.4	99
14	3.0	1653.0	139
15	4.0	1654.0	213

where $Q_c = d^{3/2}\sqrt{\dfrac{g(b+zd_c)^3}{b+2zd_c}}$ elev. 1650.0



Ref.: See Engineering Handbook for Hydraulics; Soil Conservation Service, U.S. Dept. of Agriculture; STD. DWG. ES-24.

These flows will be combined with weir section flows to determine the total discharge from Smith Pond.

Trial #1 $d_c = 0$ $\frac{Q_c}{b} = 0$ $Q_c = 0$

Trial #2 $d_c = .3$ $\frac{Q_c}{b} = .95$ $\frac{Q_c}{4.7} = .95$ $Q_c = 4.5$

Trial #3 $d_c = .4$ $\frac{Q_c}{b} = 1.45$ $\frac{Q_c}{4.7} = 1.45$ $Q_c = 6.815$

Trial #4 $d_c = .5$ $\frac{Q_c}{b} = 2$ $\frac{Q_c}{4.7} = 2$ $Q_c = 9.4$

Trial #5 $d_c = .6$ $\frac{Q_c}{b} = 2.65$ $\frac{Q_c}{4.7} = 2.65$ $Q_c = 12.45$

Trial #6 $d_c = .7$ $\frac{Q_c}{b} = 3.35$ $\frac{Q_c}{4.7} = 3.35$ $Q_c = 15.745$

Trial #7 $d_c = .8$ $\frac{Q_c}{b} = 4.08$ $\frac{Q_c}{4.7} = 4.08$ $Q_c = 19.176$

Trial #8 $d_c = .9$ $\frac{Q_c}{b} = 4.85$ $\frac{Q_c}{4.7} = 4.85$ $Q_c = 22.8$

Trial #9 $d_c = 1.0$ $\frac{Q_c}{b} = 4.85$ $\frac{Q_c}{4.7} = 5.68$ $Q_c = 26.7$

$\frac{\text{Trial \#10}}{d_c = 1.1}$ $\frac{Q_c}{b}$ 6.55 $\frac{Q_c}{4.7} = 6.55$ $Q_c = 30.785$

$\frac{\text{Trial \#11}}{d_c = 1.3}$ $\frac{Q_c}{b} = 8.42$ $\frac{Q_c}{4.7} = 8.42$ $Q_c = 39.574$

$\frac{\text{Trial \#12}}{d_c = 1.9}$ $\frac{Q_c}{b} = 14.89$ $\frac{Q_c}{4.7} = 14.89$ $Q_c = 69.983$

$\frac{\text{Trial \#13}}{d_c = 2.4}$ $\frac{Q_c}{b} = 21.1$ $\frac{Q_c}{4.7} = 21.1$ $Q_c = 99.17$

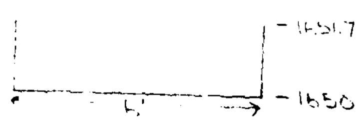
$\frac{\text{Trial \#14}}{d_c = 3.0}$ $\frac{Q_c}{b} = 29.5$ $\frac{Q_c}{4.7} = 29.5$ $Q_c = 138.65$

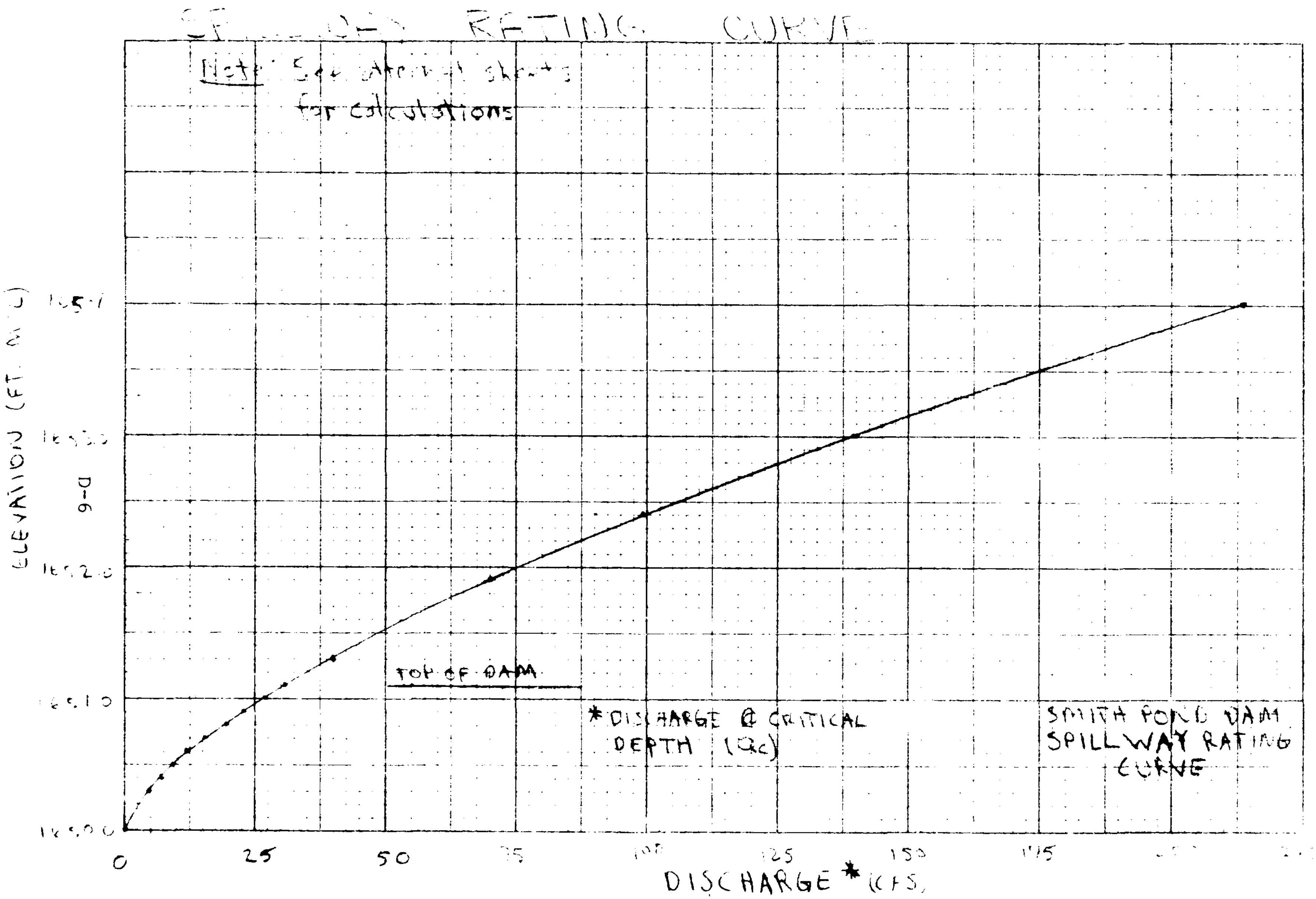
$\frac{\text{Trial \#15}}{d_c = 4.0}$ $\frac{Q_c}{b} = 45.25$ $\frac{Q_c}{4.7} = 45.25$ $Q_c = 212.675$

Spillway Sections

U/S INLET

d/S END




Note: See attached sheets for calculations
TOP OF DAM
* DISCHARGE @ CRITICAL DEPTH (Qc)
SMITH POND DAM SPILLWAY RATING CURVE
0
25
50
DISCHARGE * (CFS)

[illegible] over the main dam embankment and the [illegible] dike. A weir section across the [illegible] is shown on page 8. Determine a discharge-rating curve using the weir equation $Q = CLH^{3/2}$, where 'C' = 2.6.

Trial #1 Assume elevation @ 1650.0 (spillway elevation) Q = 0 cfs

Trial #2 Assume elevation @ 1651.1
Q = 0 cfs

Trial #3 Assume elevation @ 1651.3 (crest elevation)
Q = 0

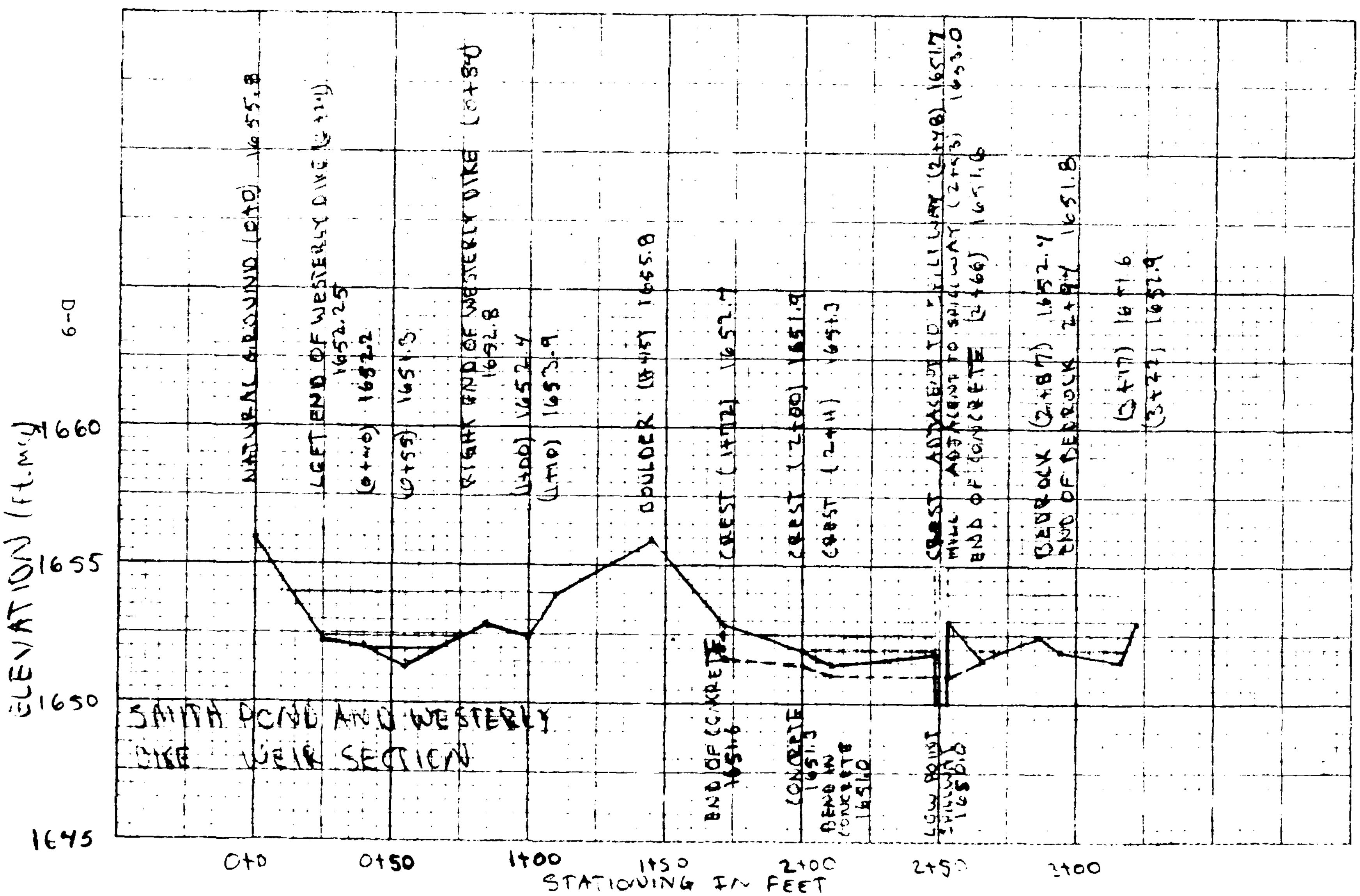
Trial #4 Assume elevation @ 1651.9 (crest elevation @ farther easterly dike) $Q = [2.6(\frac{1}{2})(12)(.6)^{3/2}] + [2.6(\frac{1}{2})(12)(.6)^{3/2}] + [2.6(\frac{1}{2})(10)(.6)^{3/2}] + [2.6(\frac{1}{2})(37)(.6)^{3/2}] + [2.6(\frac{1}{2})(5)(.3)^{3/2}] + [2.6(\frac{1}{2})(10)(.3)^{3/2}] + [2.6(\frac{1}{2})(23)(.3)^{3/2}] = 7 + 7 + 6 + 22 + 1 + 5 = 50$ cfs

Trial #5 Assume elevation @ 1652.4 (crest elevation @ farther westerly dike) $Q = [2.6(15)(.2)^{3/2}] + [2.6(\frac{1}{2})(2)(.2)^{3/2}] + [2.6(15)(.65)^{3/2}] + [2.6(\frac{1}{2})(18)(1.1)^{3/2}] + [2.6(\frac{1}{2})(30)(1.1)^{3/2}] + [2.6(37)(.9)^{3/2}] + [2.6(\frac{1}{2})(10)(.8)^{3/2}] + [2.6(\frac{1}{2})(21)(.8)^{3/2}] + [2.6(23)(.7)^{3/2}] + [2.6(\frac{1}{2})(7)(.7)^{3/2}] + [2.6(\frac{1}{2})(5)(.7)^{3/2}] = 4 + 0.2 + 20 + 27 + 45 + 82 + 9 + 20 + 35 + 5 + 4$
$= 251$ cfs

Trial #6 Assume elevation @ 1653.0
$Q = [2.6(\frac{1}{2})(5)(.3)^{3/2}] + [2.6(15)(.8)^{3/2}] + [2.6(15)(1.05)^{3/2}] + [2.6(\frac{1}{2})(30)(1.7)^{3/2}] + [2.6(\frac{1}{2})(15)(.6)^{3/2}] + [2.6(\frac{1}{2})(5)(.6)^{3/2}] + [2.6(\frac{1}{2})(40)(1.7)^{3/2}] + [2.6(37)(1.5)^{3/2}] + [2.6(\frac{1}{2})(13)(1.4)^{3/2}] + [2.6(21)(1.1)^{3/2}] + [2.6(7)(.9)^{3/2}] + [2.6(23)(1.3)^{3/2}] + [2.6(\frac{1}{2})(5)(1.3)^{3/2}] = 5 + 28 + 42 + 86 + 9 + 3 + 115 + 177 + 28 + 63 + 16 + 89 + 10 = 671$ cfs

Trial # 4 Assume elevation @ 1654.0

$$Q = \left[2.6\left(\tfrac{1}{2}\right)(12)(1.8)^{3/2}\right] + \left[2.6(15)(1.8)^{3/2}\right] + \left[2.6(15)(2.05)^{3/2}\right]$$
$$+ \left[2.6(30)(2)^{3/2}\right] + \left[2.6(15)(1.5)^{3/2}\right] + \left[2.6\left(\tfrac{1}{2}\right)(10)(1.8)^{3/2}\right] +$$
$$\left[2.6\left(\tfrac{1}{2}\right)(48)(2.7)^{3/2}\right] + \left[2.6(37)(2.5)^{3/2}\right] + \left[2.6(13)(1.7)^{3/2}\right] +$$
$$\left[2.6(21)(2)^{3/2}\right] + \left[2.6(7)(1.9)^{3/2}\right] + \left[2.6(23)(2.3)^{3/2}\right] + \left[2.6(5)(1.75)^{3/2}\right] =$$
$$38 + 94 + 114 + 221 + 72 + 31 + 277 + 380 + 75 + 154 + 48 + 209 + 30 =$$
$$1715.\ \text{cfs}$$



SMITH POND AND WESTERLY
DIKE WEIR SECTION
ELEVATION (ft.msl)
1645
1650
1655
1660
0+0
0+50
1+00
1+50
2+00
2+50
3+00
STATIONING IN FEET
NATURAL GROUND (0+0) 1655.8
LEFT END OF WESTERLY DIKE
1652.25
(0+40) 1652.2
(0+55) 1651.3
RIGHT END OF WESTERLY DIKE (0+80)
1652.8
(1+00) 1652.4
(1+10) 1653.9
BOULDER 1655.8
CREST 1652.7
CREST (2+00) 1651.9
CREST (2+11) 1651.3
END OF CONCRETE (2+66) 1651.6
BEDROCK (2+87) 1652.4
END OF BEDROCK 1651.8
(3+17) 1651.6
(3+22) 1652.9
END OF CONCRETE
1651.6
CONCRETE
1651.3
BEND IN CONCRETE
1651.0
LOW POINT
1650.0

[illegible] easterly dike [illegible] 11. Data [illegible] the weir equation $Q = CLH^{3/2}$, where [illegible]

Trial #1 Assume Elevation @ 1651.3

$$Q = 0 \text{ cfs}$$

Trial #2 Assume Elevation @ 1651.9 (low point @ farther easterly dike)

$$Q = \left[2.6\left(\tfrac{1}{2}\right)(50)(.4)^{3/2}\right] + \left[2.6\left(\tfrac{1}{2}\right)(25)(.4)^{3/2}\right] + \left[2.6\left(\tfrac{1}{2}\right)(20)(.6)^{3/2}\right] + \left[2.6(40)(.6)^{3/2}\right]$$

$$Q = 6 + 6 + 12 + 48 = 84 \text{ cfs}$$

Trial #3 Assume Elevation @ 1652.4 (low point @ farther westerly dike)

$$Q = \left[2.6(50)(.7)^{3/2}\right] + \left[2.6\left(\tfrac{1}{2}\right)(50)(.9)^{3/2}\right] + \left[2.6\left(\tfrac{1}{2}\right)(20)(1.3)^{3/2}\right] + \left[2.6(40)(1.1)^{3/2}\right]$$

$$Q = 76 + 55 + 39 + 120 = 290 \text{ cfs}$$

Trial #4 Assume Elevation @ 1653.0

$$Q = \left[2.6(50)(1.3)^{3/2}\right] + \left[2.6(50)(1.15)^{3/2}\right] + \left[2.6(20)(1.35)^{3/2}\right] + \left[2.6(40)(1.7)^{3/2}\right]$$

$$Q = 193 + 160 + 82 + 231 = 666 \text{ cfs}$$

Trial #5 Assume Elevation @ 1654.0

$$Q = \left[2.6(50)(2.3)^{3/2}\right] + \left[2.6(50)(2.15)^{3/2}\right] + \left[2.6(20)(2.35)^{3/2}\right] + \left[2.6(40)(2.7)^{3/2}\right]$$

$$Q = 453. + 410 + 187 + 461 = 1511.$$

(4) [illegible] . A weir section across this outlet is shown on page 11. Determine a discharge-rating curve using the weir equation $Q = CLH^{3/2}$, where C is 2.6.

Trial #1 Assume elevation @ 1651.4 (crest elevation)
$Q = 0$

Trial #2 Assume elevation @ 1652.4 (low point @ farther westerly dike)
$Q = [2.6(25)(.5)^{3/2}] = 23$ cfs

Trial #3 Assume elevation @ 1653.0
$Q = [2.6(25)(1.1)^{3/2}] = 75$ cfs

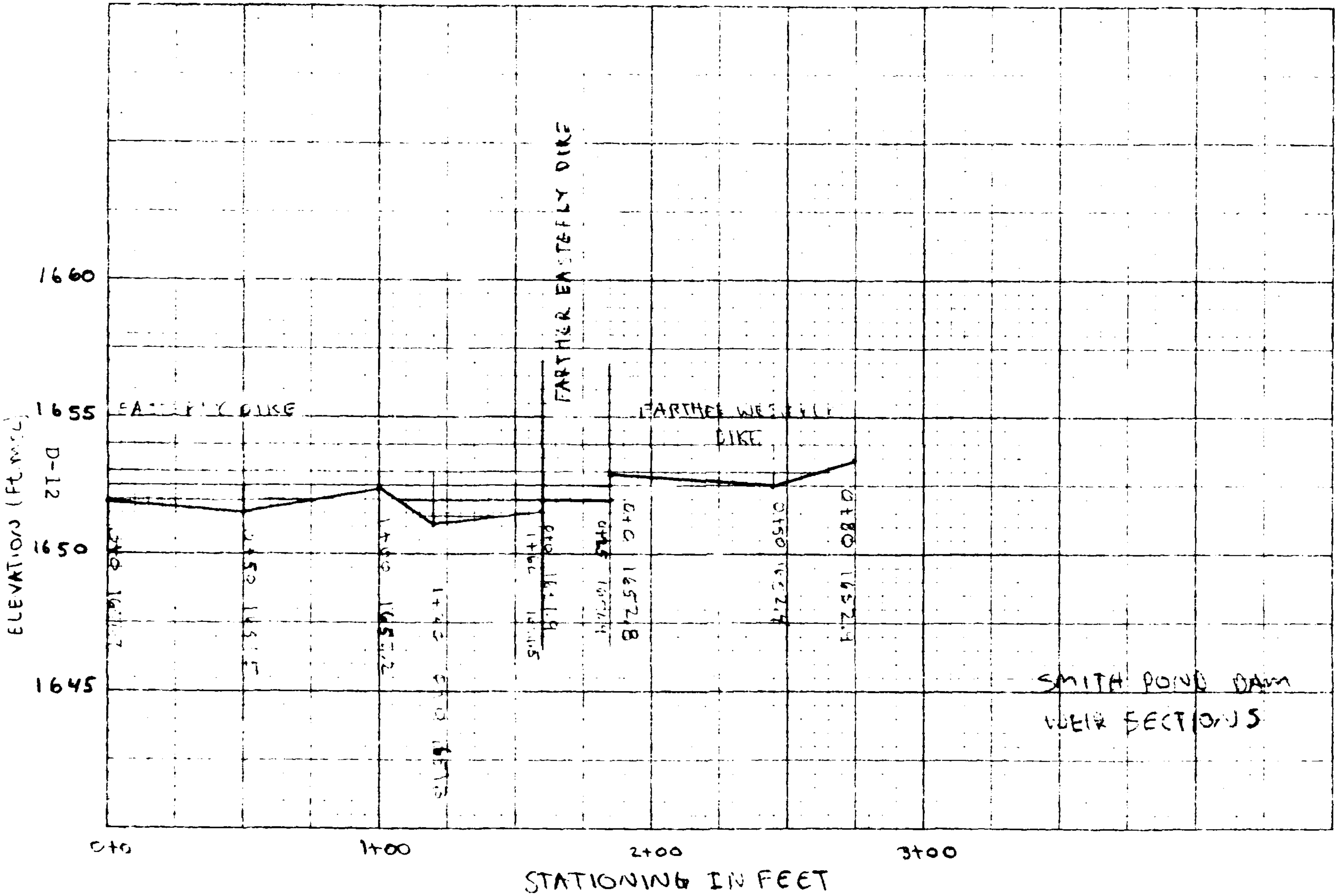
Trial #4 Assume elevation @ 1654.0
$Q = [2.6(25)(2.1)^{3/2}] = 198$ cfs

(5) Farther westerly dike . A weir section across this outlet is shown on page 15. Determine a discharge-rating curve using the weir equation $Q = CLH^{3/2}$ where C is 2.6.

Trial #1 Assume elevation @ 1652.4 (low point @ dike)
$Q = 0$

Trial #2 Assume elevation @ 1653.0
$Q = [2.6(\frac{1}{2})(50)(.6)^{3/2}] + [2.6(\frac{1}{2})(15)(.6)^{3/2}]$
$Q = 30 + 9 = 39$ cfs

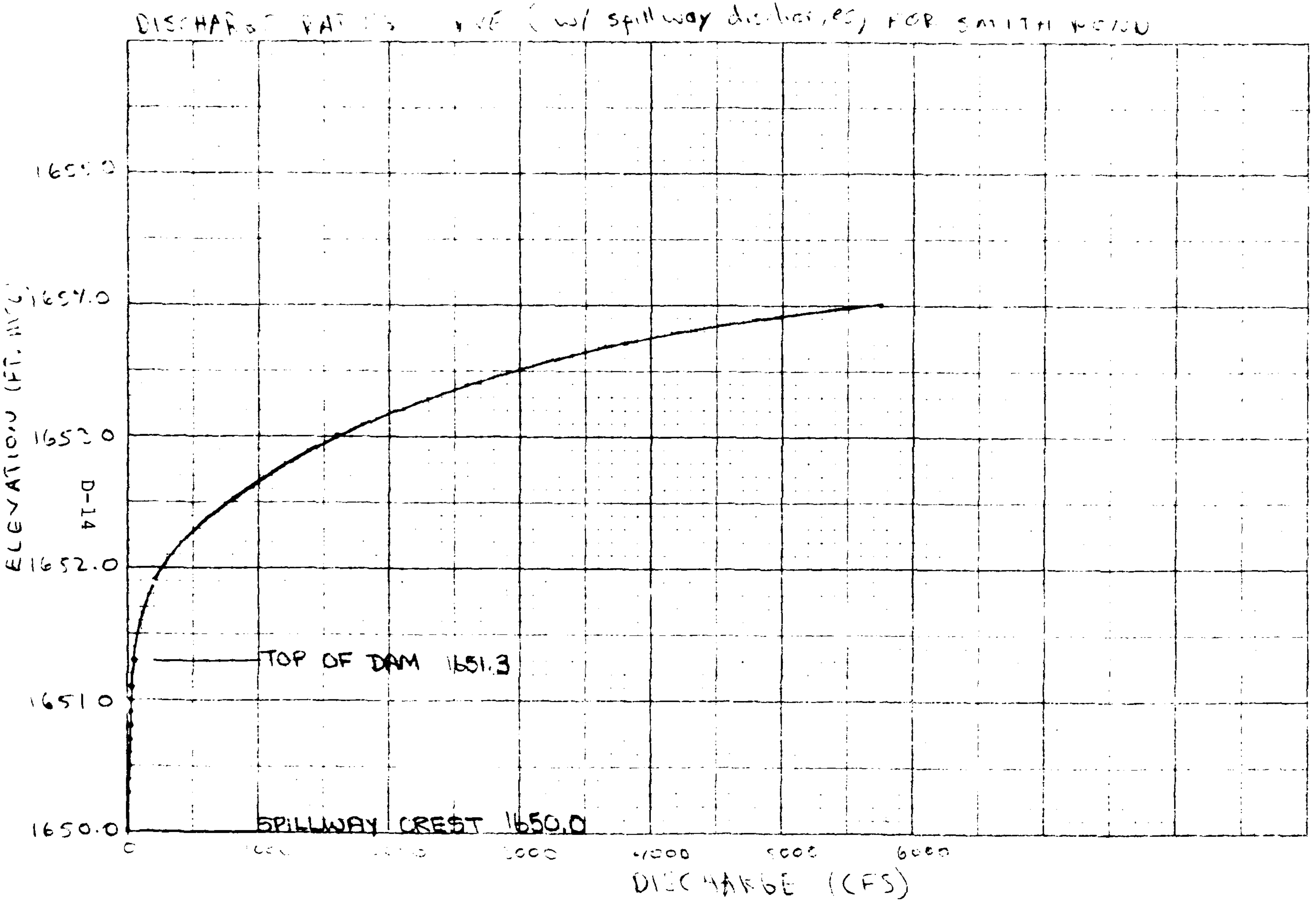
Trial #3 Assume elevation @ 1654.0
$Q = [2.6(\ldots)(1.4)^{3/2}] + [2.6(30)(1.35)^{3/2}]$
$Q = 215 + 122 = 337$ cfs



SMITH POND DAM
WEIR SECTIONS
FARTHER EASTERLY DIKE
DIKE
0+80 1652.9
0+C 1652.8
1660
1655
1650
1645
0+0
1+00
2+00
3+00
STATIONING IN FEET

Make a composite discharge rating curve including the discharges through the spillway for Smith Pond

Elevation	Q1 (cfs)	Q2 (cfs)	Q3 (cfs)	Q4 (cfs)	Q5 (cfs)	Q total
1650.0	0					0
1650.3	5					5
1650.4	7					7
1650.5	9					9
1650.6	12					12
1650.7	16					16
1650.8	19					19
1650.9	23					23
1651.0	27					27
1651.1	31					31
1651.3	40	0	0			40
1651.9	70	50	84	0		204
1652.4	99	255	290	23	0	667
1653.0	139	681	666	75	29	1600
1654.0	213	1743	1511	198	337	5745


TOP OF DAM 1651.3
SPILLWAY CREST 1650.0
1652.0
1651.0
1650.0
0
6000
DISCHARGE (CFS)
ELEVATION

Step # 2a. Test Flood Inflow = 1150 cfs
Elevation @ 1150 cfs = 1652.7' msl

Step #2b. Determine Volume of Surcharge in Inches of Runoff.

From past reference (see page 15) average depth was found to be 11 feet & calculations the surface area of the pond is 62 acres therefore the storage of 200 Ac-Ft, which yeilds an average depth of 3 feet, is unreasonable, and therefore was not used.

Normal Storage (spillway crest - 1650.0) = 680 Ac-Ft
Surface Area = 62 Acres

Using "Frustum of Pyramid Equation" and planimetered surface areas, develop points for a storage - elevation curve.

$$V = \frac{1}{3}h\,(b_1 + b_2 + \sqrt{b_1 \times b_2})$$

→ enlarged surface area (Ac)
→ normal pool surface area (Ac)

@1650 Storage @ spillway crest . 680 Ac-Ft

@1660 Surface Area = 115 Acres

$V = \frac{1}{3}10\left[(62+115)+\sqrt{62\times115}\right]$

= 871 Ac-Ft

Total Storage @ 1660 = 1550 Ac-Ft

@1680 Surface Area = 140 Acres

$V = \frac{1}{3}20\left[(115+140)+\sqrt{115+140}\right]$

= 2546 Ac-Ft

Total Storage @ 1680 = 4097 Ac-Ft

DATE: December 11, 1972

FROM: Pattu D. Kesavan, Water Resources Engineer

SUBJECT: Smith Pond, Enfield, N.H.

TO: Vernon A. Knowlton, Chief Water Resources Engineer

Based on the Special Forestry Program's letter of February 29, 1972, I went to Enfield on November 27, 1972, to inspect the illegal dam at the outlet of Smith Pond.

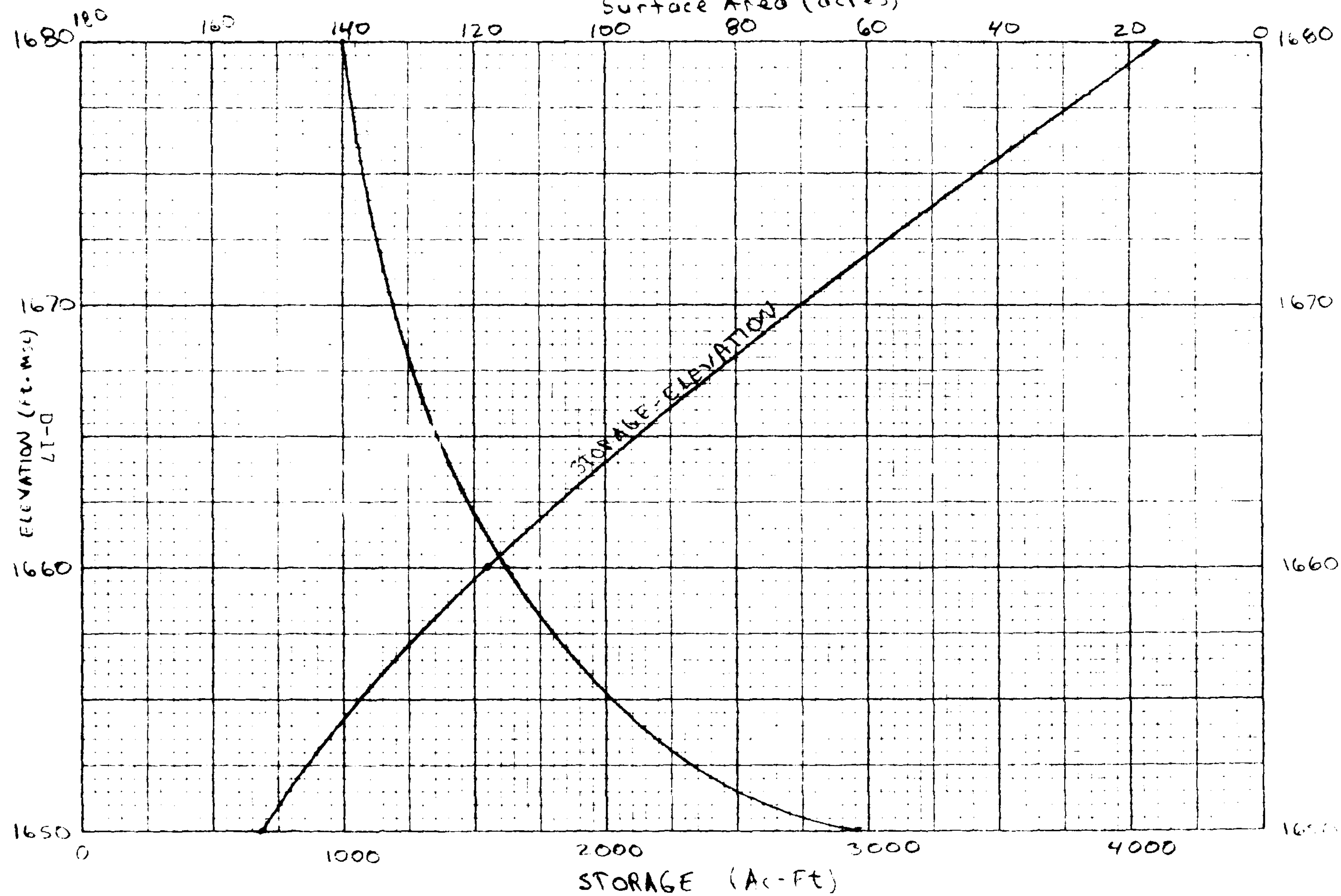
Due to the weather conditions, I was unable to get to the site, but I gathered some information from the Town Clerk. LaSalette Seminary, Enfield, bought this dam from Shakers who might have built the dam in the late 1800's. Referring to our old town blueprints, this present Smith Pond is shown as three small ponds called lily ponds, and are approximately six to seven acres each in area.

In my opinion, these three ponds were impounded together when the dam was built in the late 1800's and became one large pond, known as Smith Pond. The latest data available on the Smith Pond indicates that this is a natural pond raised by damming with an area of 96 acres. Maximum depth sounded 36 feet and average depth 11 feet.

PDK/js

Smith Pond Dam Storage Elevation & Surface Elevation Curves

6/7/79



From [illegible] curve [illegible] page 16.

Q_{p_1} = 1150 cfs = 1652.7
Storage at 1652.75 ⇒ 875 Ac-Ft

195 Ac-Ft × $\frac{1}{.9\ mi^2}$ × $\frac{1\ mi^2}{640\ Ac}$ × 12 in/Ft = 4.06" runoff
(STOR 1)

Step #1c
$Q_{p_2} = Q_{p_1} \times \left(1 - \frac{STOR\ 1}{19''}\right)$

$Q_{p_2} = 1150\ cfs \times \left(1 - \frac{4.06''}{19''}\right)$

Q_{p_2} = 904 cfs ⇒ elevation of 1652.6
@ 1652.6 ⇒ 860 Ac-Ft

Step #1d Determine surcharge height to pass Q_{p_2} of 904 cfs.
Q_{p_2} 904 cfs ⇒ 1652.6 ⇒ Stor 860 Ac-FT

180 Ac-Ft × $\frac{1}{0.9\ mi^2}$ × $\frac{1\ mi^2}{640\ Ac}$ × 12 in/Ft = 3.75 run off
(STOR 2)

Step #1e Average STOR 1 and STOR 2
STOR 1 = 4.06"
STOR 2 = 3.75"
Ave = 3.91" or 0.325' runoff

0.325' × $\frac{0.9\ mi^2}{1}$ × $\frac{640\ Ac}{mi^2}$ = 187 Ac-Ft

187 Ac-Ft + 680 Ac-Ft = 867 Ac-Ft
867 Ac-Ft ⇒ 1652.7 ⇒ 1080 cfs

Test Flood = ½ PMF
Test Flood Inflow = 1150 cfs
Test Flood Discharge (after routing) = 1080 cfs, reflecting negligible surcharge storage effects
Test Flood Elevation = 1652.7

Depth of Overtopping over structures:
Spillway elev. 1650 - depth ⇒ 2.7'
Main dam embank. 1651.3 - depth ⇒ 1.4'
Easterly dike 1651.3 - depth ⇒ 1.4'
Far easterly dike 1651.9 ⇒ 0.8'
Near westerly dike 1651.3 ⇒ 1.4'
Far westerly dike 1652.4 ⇒ 0.3'

Top of dam - 1651.3 - dam would be overtopped by 1.4' during test flood.

Storage @ top dam = 775 AC-FT

Spillway capacity @ 1651.3 = 40 cfs which is 4 percent of test flood discharge.

Breach Analysis

Determine effects of breach at top of dam to classify downstream hazard condition

$Q_p = 8/27\ W_b \sqrt{g}\ Y_0^{3/2}$

W_b = breach width

$g = 32.2\ ft/sec^2$

Y_0 = pool elevation - u/s riverbed

$W_b = 149 \times 0.4 = 60'$

$Y_0 = 1651.3 - 1640.7 \approx 11$

From above equation $Q_p = 8/27\ 60\ \sqrt{32.2}\ 11^{3/2} = 3680$ cfs

Breach Q = 3680 cfs

Reach #1

Use a typical cross section along the downstream reach which extends from dam 350 feet downstream. This area would provide some storage effects. Develop a rating curve for this section by use of Mannings Equation: $Q = \frac{1.49}{n} \cdot A \cdot R^{2/3} \cdot S^{1/2}$

n = composite 'n' value

A = area of section (ft^2)

$R = \frac{A}{wp}$ (wetted perimeter)

S = slope of reach

Length of reach - 350 feet

Elevation @ dam toe - 1641.0

Elevation @ cross section - 1631.0

Slope of reach - 0.03 ft/ft.

Composite 'n' - 0.07

Trial #1 Assume stage @ 1'

Area trap. = ½ height (base₁ + base₂)

= ½ (1) (50 + 60) = 55 ft²

wp = 50 + 5 + 5 = 60 ft

R = 55/60 = [illegible]

Q = [illegible] · 55 · 0.92^{2/3} · 0.03^{1/2}

Q = 11[illegible] cfs

Trial #2 Assume stage @ 2'

Area trap. = ½(2)(50 + 65)

115 ft²

wp = 50 + 8 + 8 = 66

R = 115/66 = 1.74

Q = 1.49/0.0[illegible] · 115 · 1.74^{2/3} · 0.03^{1/2}

Q = [illegible] cfs

Trial #3 Assume stage @ 5'

Area trap. = ½(5)(50 + 90)

= 350 ft²

wp = 50 + 21 + 21 = 92 ft²

R = 350/92 = 3.8

Q = 1.49/0.04 · 350 · 3.8^{2/3} · 0.03^{1/2}

Q = 3,472 cfs

Trial #4 Assume stage @ 6'

Area trap. = ½(6)(50 + 95)

= 435 ft²

wp = 50 + 23 + 23 = 96

R = 435/96 = 4.5

Q = 1.49/0.04 · 435 · 4.5^{2/3} 0.03^{1/2}

Q = 4,3[illegible] cfs

Q_p [illegible] Q = 3680 cfs

Stage = 5.5

Area = 3[illegible] ft² × 3[illegible]0 ft × 1 ac/43560 = 2.8 Ac Ft

Q_p [illegible] $Q_p\left(1 - \frac{V}{S}\right)$

$3680\left(1 - \frac{2.8}{[illegible]}\right)$

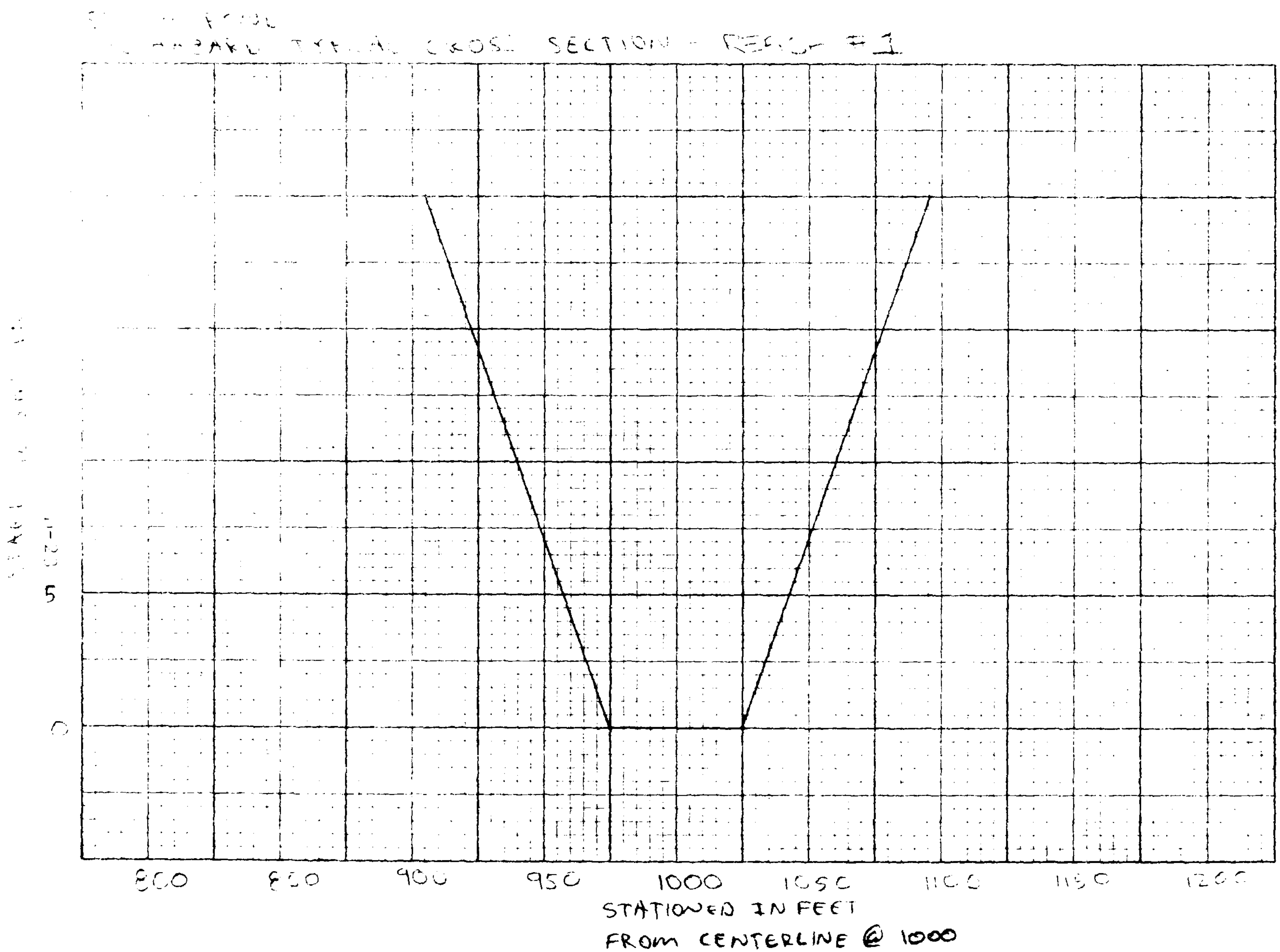
3610 [illegible]

$Q = 3670$ cfs

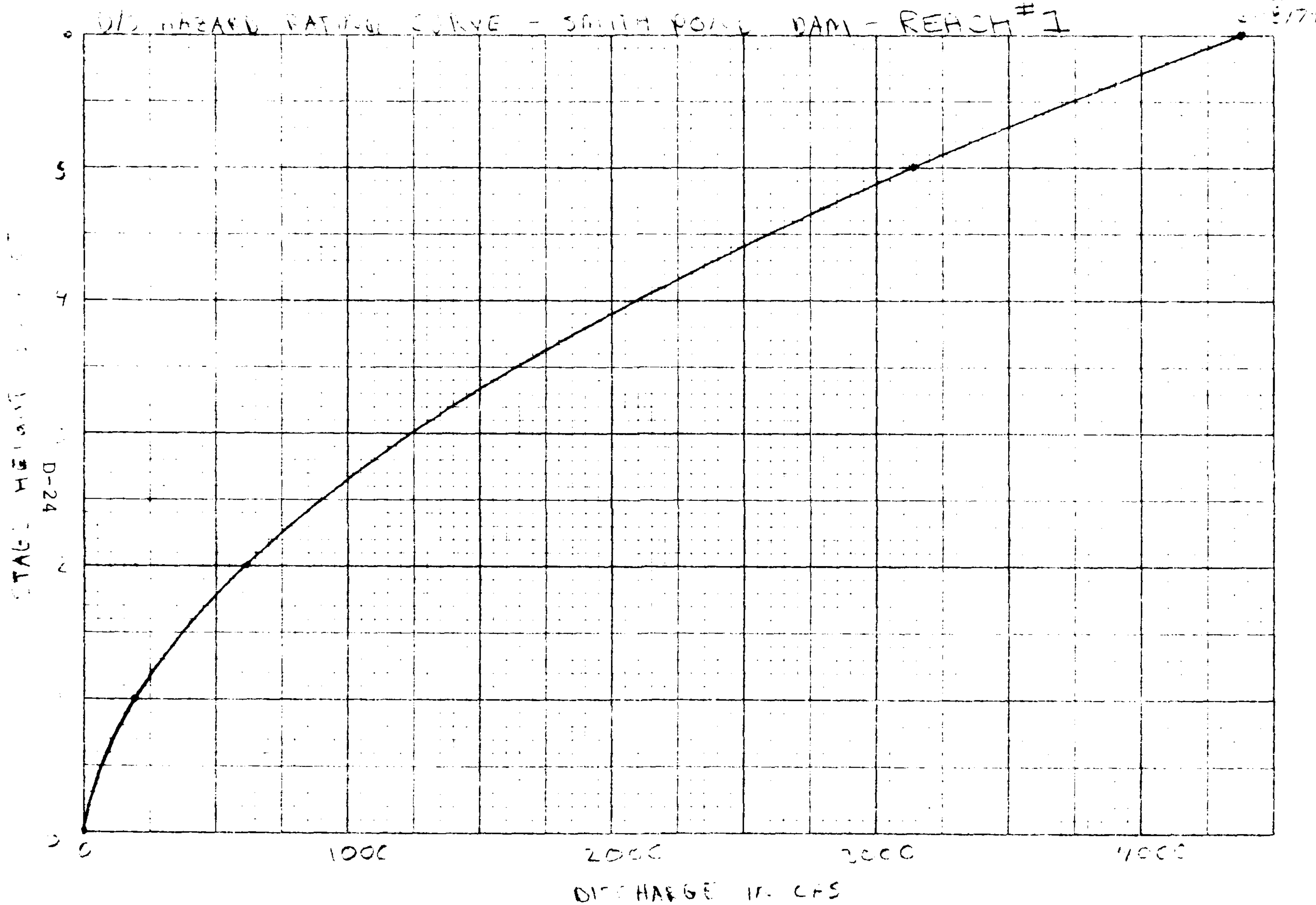
Stage = 5.5'

Antecedent discharge = 40 cfs = 0.4'

Increase in Reach 1 by breach would be 4.1 ft.



5
0
800
850
900
950
1000
1050
1100
1150
1200
STATIONED IN FEET
FROM CENTERLINE @ 1000


D/S HAZARD RATING CURVE - SMITH POND DAM - REACH #1
0
1000
2000
3000
4000
DISCHARGE IN CFS
5
4
2
0

REACH #2

Use a typical [illegible] section along the downstream reach which extends from [illegible] feet downstream of the dam to the [illegible]fluence with Mascoma Lake a distance of 7000 feet (1.3 miles). Develop a rating curve for this section by use of Mannings Equation:

$$Q = \frac{1.49}{n} \cdot A \cdot R^{2/3} \cdot S^{1/2}$$

- n = composite 'n' value
- A = area of section (ft^2)
- R = A/wp (wetted perimeter)
- S = slope of reach

Length of reach = 7000 feet
Elevation @ cross section - 1631.0
Elevation @ Mascoma Lake - 751.0
Slope of reach - .13
Composite 'n' - .09

Trial #1 Assume stage @ 2'

Area = Area Trap. + Area Triangle

$= \frac{1}{2}$ height $(b_1 + b_2)$ + $\frac{1}{2}$ · depth · width

$= 0 + \frac{1}{2}(2)(5)$

$= 5\ ft^2$

$wp = 5 + 3 + 3 = 11$

$R = \frac{5}{11} = .45$

$Q = \frac{1.49}{.09} \cdot 5 \cdot 0.45^{2/3} \cdot 0.13^{1/2}$

$= 18$ cfs

Trial #2 Assume stage @ 3'

Area = $\frac{1}{2}(1)(10 +$ [illegible] $+ \frac{1}{2}\ 4\ (10)$

[illegible] + 20 = 35 ft^2

wp = 20 + 6 + 6 + 5 + 5 = 42

R = 35/42 = .83

$Q = \frac{1.49}{.09} \cdot 35 \cdot 0.83^{2/3} \cdot 0.13^{1/2}$

= 185 cfs

Trial #3 Assume stage @ 10'

Area = ½(6)(10+60) + ½(4)(10)

= 210 + 20 = 230 ft²

wp = 60 + 20 + [illegible] = 122

$R = \frac{230}{122} = 1.89$

$Q = \frac{1.49}{.09} \cdot 230 \cdot 1.89^{2/3} \cdot 0.13^{1/2}$

= 2099 cfs

Trial #4 Assume stage @ 15'

Area = ½(11)(10+110) + ½(4)(10)

= 660 + 20 = 680 ft²

wp = 110 + 51 + 51 + 5 + 5 = 220

R = 680/220 = 3.06

$Q = \frac{1.49}{.09} \cdot 680 \cdot 3.06^{2/3} \cdot 0.13^{1/2}$

= 8555 cfs

This reach would provide no storage

Q = 3670 cfs

Stage = 11.5'

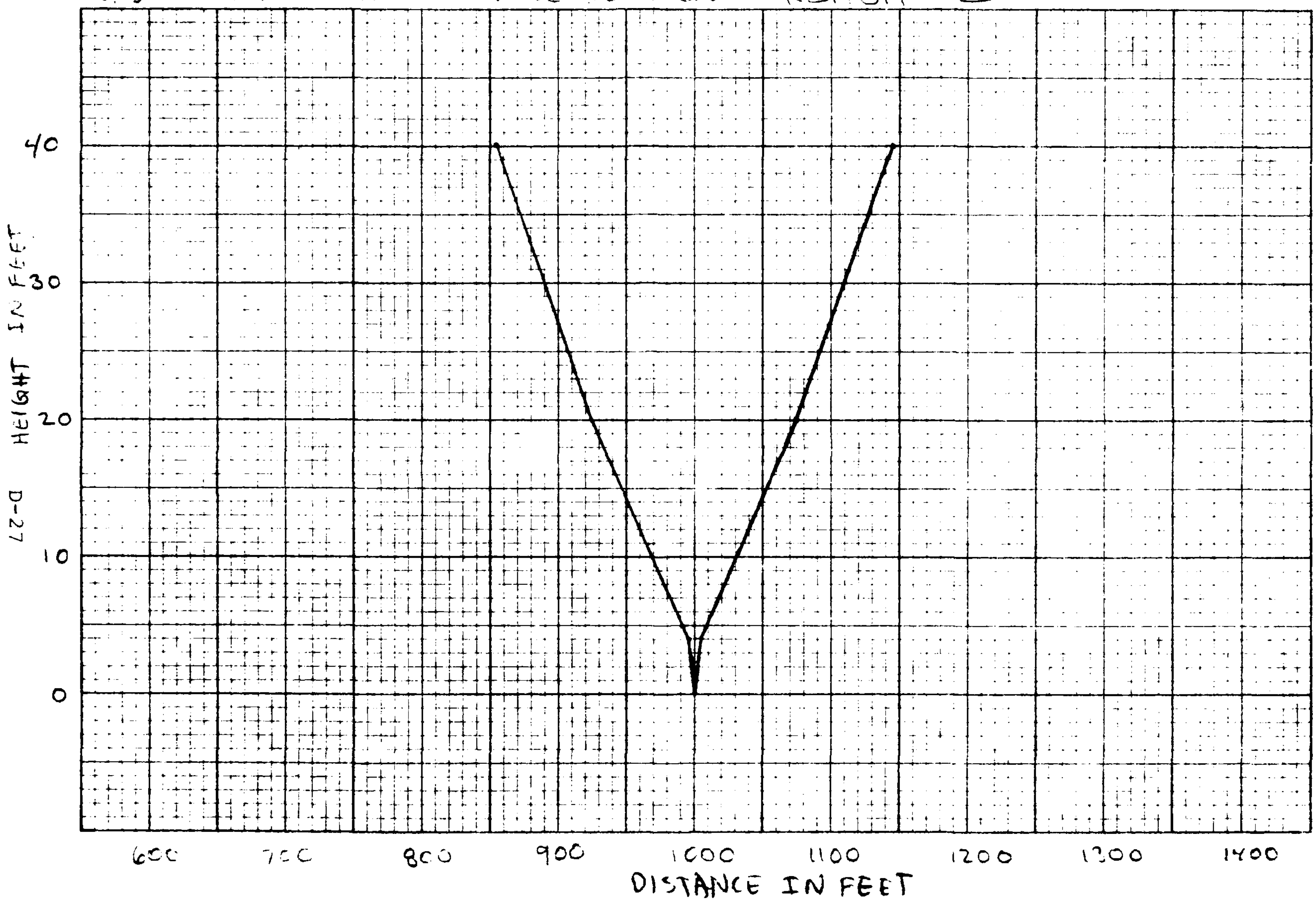
Antecedent discharge = 40 cfs

Stage = 3'

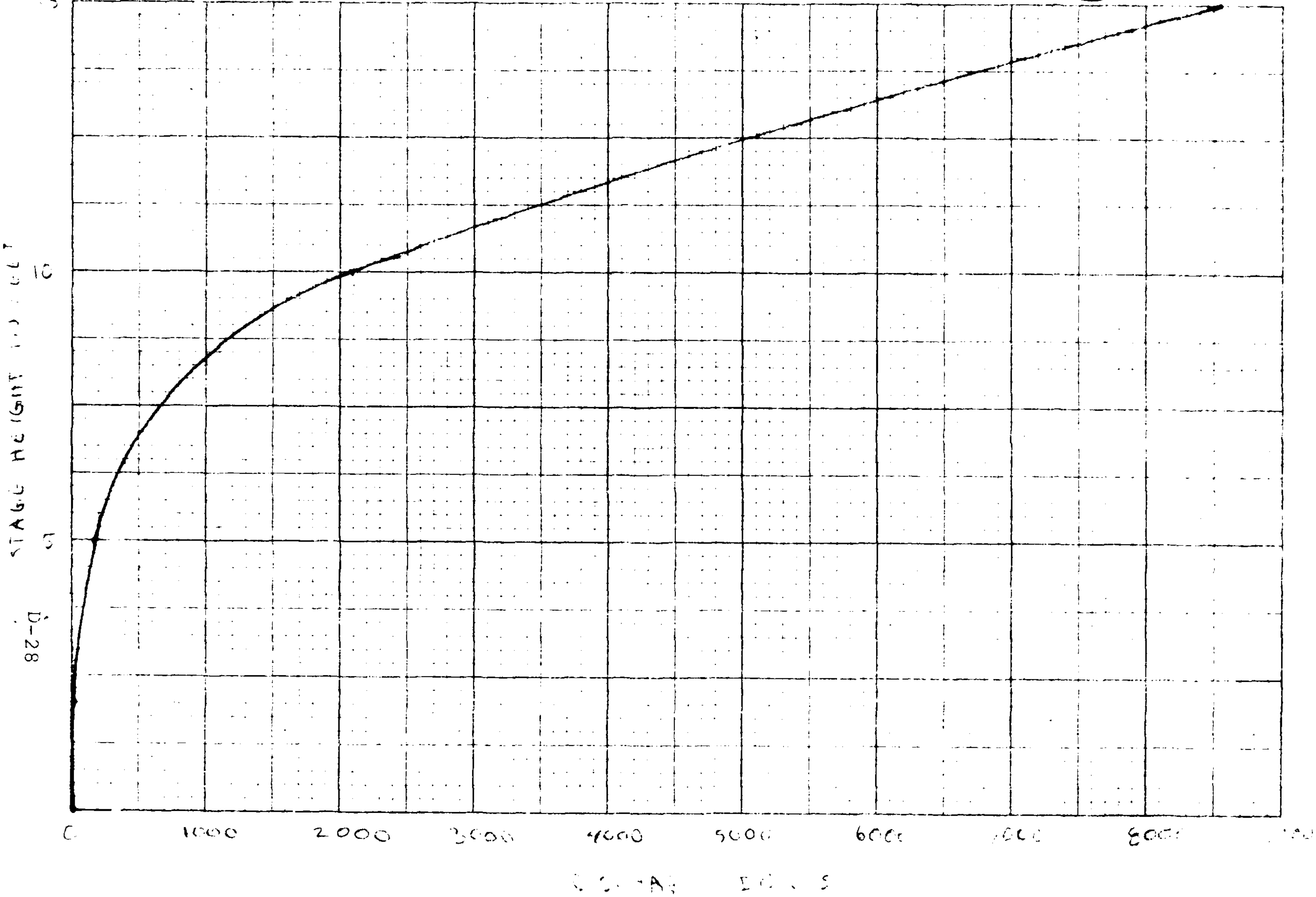
Total increase in stage = 8.5 along the reach

SMITH POND DAM

D/S HAZARD TYPICAL CROSS SECTION - REACH #2



U/S HAZARD RAT... - REACH #2



STATE ROUTE 4A ROAD

$L = 48$ feet

54" ₵ culvert

HW Available = 4'

Area = 16 ft^2

$Q = CA\sqrt{2gh}$ (ORIFICE EQUATION)

$$K_f = \frac{29.1\,(n)^2 L}{R^{4/3}}$$

R = Area / wetted perimeter = 1.13

$n = 0.024$

$L = 48'$

$K_f = 0.68$

Assume entrance and exit losses ≈ 1.1

∴ Total = 1.1 + 0.68 = 1.78

$K = \frac{1}{C^2}$ $\quad 1.78 = \frac{1}{C^2}$ $\quad C = 0.75$

Assume WSEL @ top of road

$Q = 0.75\,(16)\sqrt{2(32.2 \times 6.25}$

$Q_{culvert} = 240.75$ cfs

Develop a ... for the State Route 4A bridge using the ... on page 31, to determine depth of flow over road.

$Q_1 = CA\sqrt{2gh}$ (Orifice Equation) $C_1 = 0.75$

$Q_2 = C_2 L H^{3/2}$ (Weir Equation) $C_2 = 2.6$

Trial No. 1 Assume stage elevation at 0' (top of road)

$Q = 241$ cfs

Trial No. 2. Assume stage elevation at 1'

$Q_1 = CA\sqrt{2gh}$ $C = 0.75$ $A = 16$ ft² ... 7.25 ft

$= 0.75(16)\sqrt{2(32.2 \times 7.25)}$

$= 259$ cfs

<u>Q TOTAL</u> = 662

$Q_2 = CLH^{3/2}$

$= [2.6(\tfrac{1}{2})(10)(\;)^{3/2}] + [2.6(100)(\;)^{3/2}] + [2.6(\tfrac{1}{2})(100)(\;)^{3/2}]$

$= 13 + 260 + 130$

$= 403$ cfs

Trial No. 3 Assume stage elevation at 2'

$Q_1 = 0.75(16)\sqrt{2(32.2 \times 8.25)}$

$= 277$ cfs

$Q_2 = [2.6(\tfrac{1}{2})(20)(2)^{3/2}] + [2.6(100)(2)^{3/2}] + [2.6(100)(1.5)^{3/2}]$

$= 74 + 735 + 628$

$= 1437$

<u>Q TOTAL</u> = 1714

Trial No. 4 Assume stage elevation at 3'

Q_1 $0.75(16)\sqrt{2(32.2 \times 9.25)}$

$= 293$ cfs

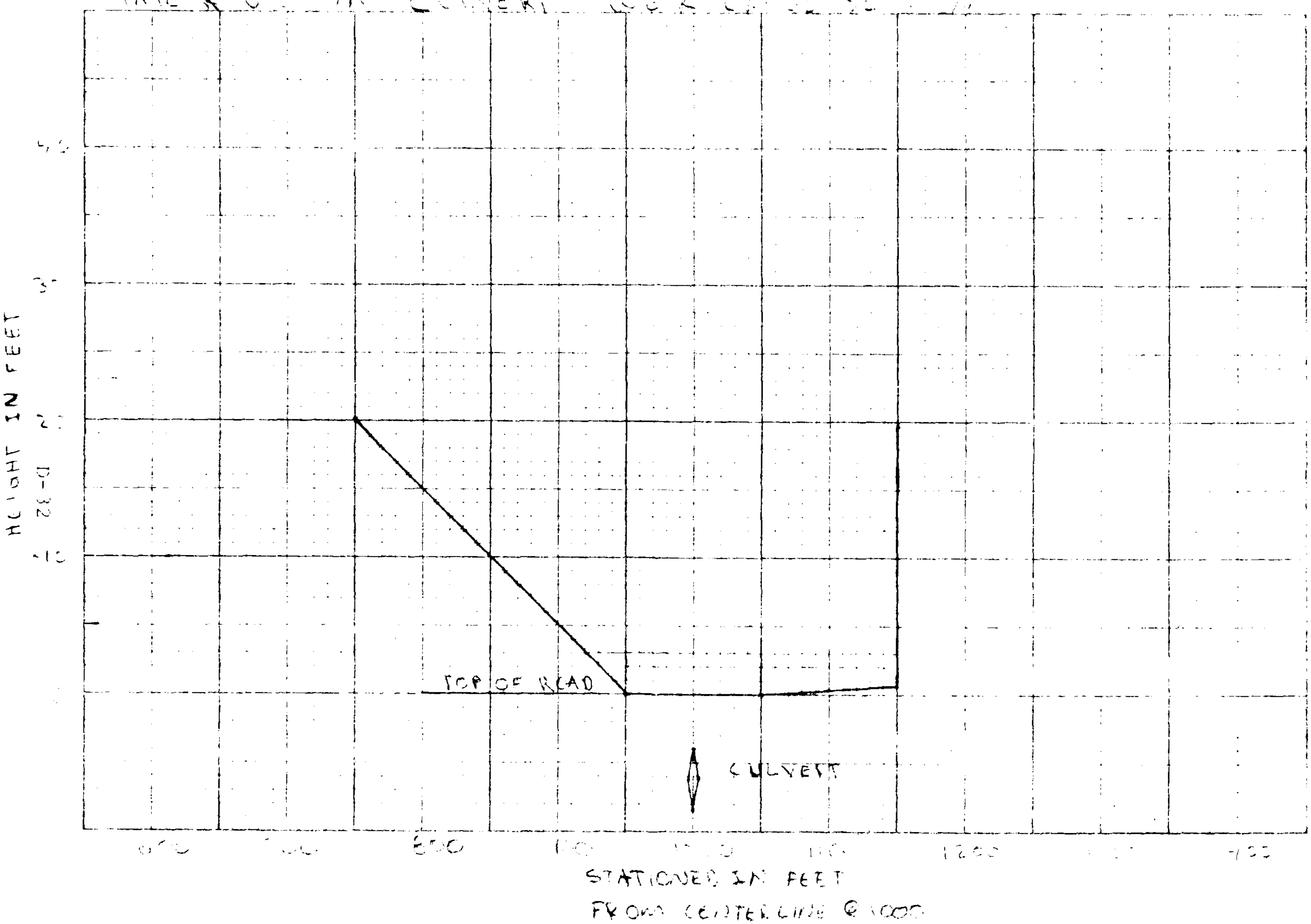
<u>Q TOTAL</u> = 3065

$Q_2 = [2.6(\tfrac{1}{2})(30)(3)^{3/2}] + [2.6(100)(\;)^{3/2}] + [2.6(100)(2.8)^{3/2}] +$

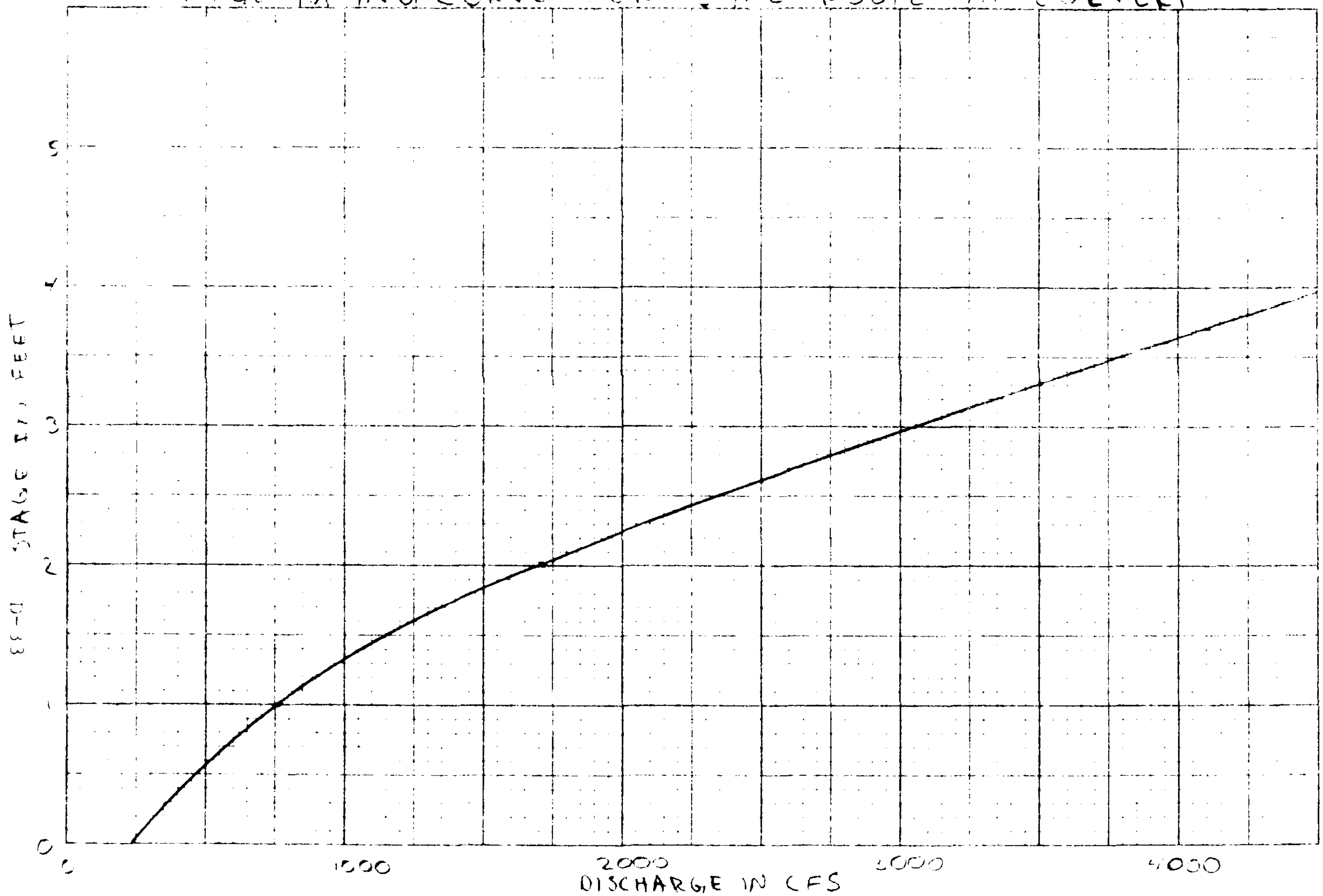
$203 + 251 + 1218$

[illegible]
[illegible] 111.52'
[illegible] would cause
appreciable property damage to
State Route 4A and 4 inhabited
structures. One house located on
the [illegible] side of the road
would be severely damaged. There
would be a potential for the loss
of 4-6 lives and appreciable
[illegible] would likely
occur. Therefore, Smith Pond
Dam was classified <u>Significant</u>
<u>Hazard.</u>

SMITH POND DAM



SMITH POND DAM
DISCHARGE RATING CURVE FOR STATE ROUTE 4A CULVERT



APPENDIX E

INFORMATION AS
CONTAINED IN THE NATIONAL
INVENTORY OF DAMS